WILLIAM T. CRUSE, Editor
DR. GORDON M. KLINE, Technical Editor
HARRIET B. JOSEPHS, Associate Editor
JUNE GUNCHEON, Associate Editor

modern plastics

JANUARY 1941
VOLUME 18 NUMBER 5

FEBRUARY

Heretofore injection molded plastics for refrigerator interiors have been confined to extremely small parts such as shelf studs or bosses. The physical inadequacies of the available materials had retarded the refrigeration industry's acceptance of injection molded plastics. Current models are, for the first time, using materials molded by this method for large structural, functional pieces, such as evaporator doors. Control devices and other major parts made of plastics appear on the 1941 models.

• GENERAL INTEREST

Plastic-plywood 27
Building by squares 32
Plasti-City, Washington, D. C. 34
It's in style 36
Urea resin adhesives 44
Luminescent and fluorescent plastics 45

• TECHNICAL SECTION

Advances in plastics during 1940 53
Phenolic resin bonded airplane 64
Plastics digest 66
U. S. plastics patents 68

• NEWS AND FEATURES

Product development 40
Plastics in review 48
Stock molds 52
Publications 74
Machinery and equipment 76
In the limelight 78

CHARLES A. BRESKIN, Publisher ALAN S. COLE, General Manager

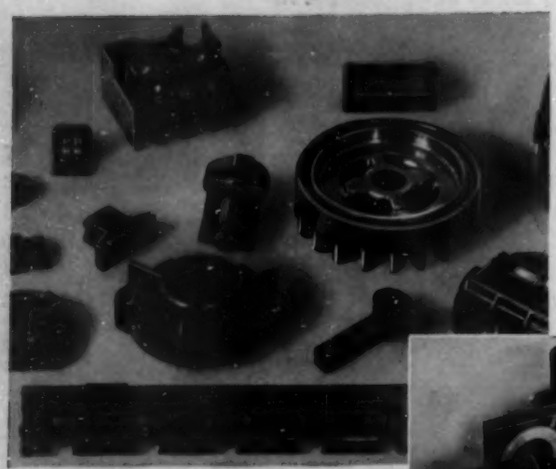
DONALD R. RUTHER, Art Director R. G. GERMAISE, Circulation P. H. BACKSTROM, Advertising Mgr. J. M. CONNORS, Mid-West Mgr.
E. R. GORDON, Production WALTER S. ROSS, Promotion M. A. OLSEN, Eastern Mgr. LOYD B. CHAPPELL, West Coast Mgr.

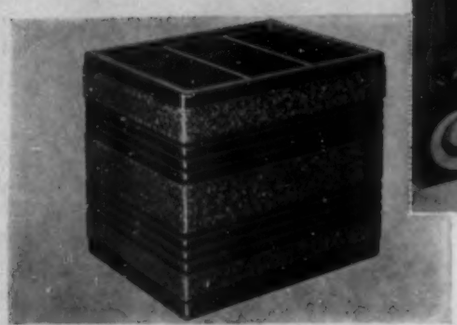
Published the 5th of each month by Breskin Publishing Corporation. Publication office, Twentieth and Northampton Sts., Easton, Pa. Executive and Editorial Offices, 122 E. 42nd St. (Chanin Bldg.), New York, N. Y. Phone AShland 4-0655. Mid-Western office, 221 N. LaSalle St., Room 1338, Chicago, Ill. Phone Randolph 6336. Pacific Coast Office, 427 West 5th St., Los Angeles, Cal. Also Publishers of Modern Plastics Catalog, Modern Packaging, Packaging Catalog. Subscription price $5.00 per year, $8.00 for 2 years in U. S., its possessions and South America. Canadian subscriptions $5.50 per year, $9.00 for 2 years, all other countries, $6.00 per year, $10.00 for 2 years, payable in American money or its equivalent. Price 50¢ per copy, except October issue, which is $2.00
Copyright 1940 by Breskin Publishing Corp. All rights reserved.
Printed in U. S. A. Entered as second class matter May 28, 1940, at the Post Office at Easton, Pa., under the Act of March 3, 1879. Back numbers (except October) 3 months or more preceding current issue, when available, $1.00 each. Modern Plastics fully protected by copyright and nothing that appears in it may be reprinted, either wholly or in part, without special permission.

Member of Controlled CCA Circulation Audit

ADVERTISING PAGES REMOVED

A great Family of great Plastics





INSUROK

Molded • Laminated • Translucent

Almost daily, industry and commerce find new uses and applications for INSUROK, the precision plastic. Countless thousands of molded and laminated INSUROK parts pour from Richardson plants to serve useful purposes in products and in production equipment.

Translucent INSUROK adds the appeal of color to coin-operated machines, and gives new sales power to displays of all types and sizes, large and small.

INSUROK is available in many grades; in sheets, rods and tubes for fabrication in your own plant, or in completely finished parts and products ready for assembly.

INSUROK, exclusively Richardson, offers many advantages to every plastics user. The facts are yours for the asking.

EBROK

Bituminous plastic for storage battery containers. Resists impact, corrosion, temperature changes, destructive action of electrolyte. Can be adapted for other uses.

VALVSEAL—the new battery cover that automatically regulates the height of electrolyte in cells . . . prevents overflow of battery acid.

RUB-TEX

Hard rubber for acid buckets, trays, special chemical handling equipment, and parts for electrical use. Acid resistant, non-corrosive, highly dielectric.

MICAROK

High quality sheet mica for electrical insulation. Can be sheared, and punched with ease, edges remaining clean and sharp. High insulating value at low cost.

RUB-EROK

An insulating material possessing unusual structural strength and dielectric characteristics. It is widely used in radio, television and other electrical applications.

RICHARDSON TECHNICAL SERVICE. Available without cost or obligation to assist in solving your plastics problems. Literature and details on request.

The RICHARDSON COMPANY

Melrose Park, (Chicago) Ill. Founded 1858 Lockland, (Cincinnati)-Ohio
New Brunswick, N. J. Indianapolis, Ind.
Detroit Office: 4-252 G. M. Building, Phone Madison 9386
New York Office: 75 West Street, Phone Whitehall 4-4487

MODERN PLASTICS

WILLIAM T. CRUSE, Editor

JANUARY 1941 VOLUME 18 NUMBER 5

Plastic-Plywood

by L. H. Meyer*

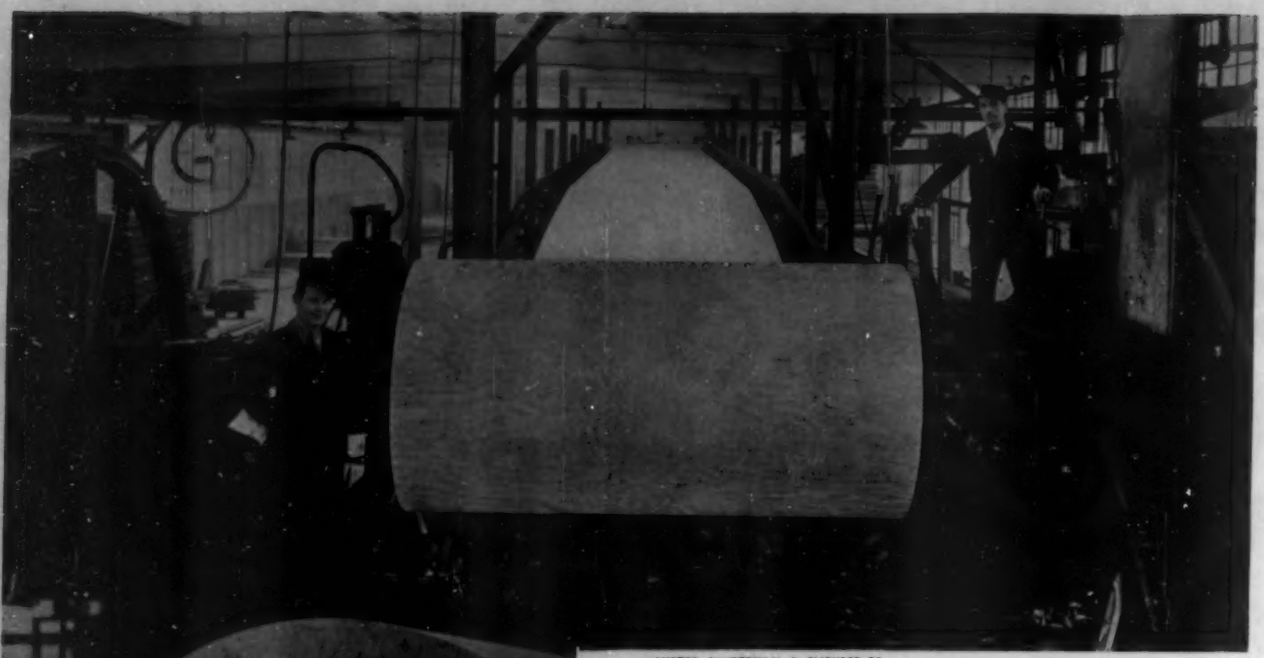
While plastics serve industry on many fronts perhaps in no sector have they come to play a more important functional part than in plastic plywood. Great technological advances have been made in plastics, and in adopting them, the plywood industry has taken advantage of such progress in developing plastic plywood. These new materials open broad possibilities for countless new applications and they will more successfully serve those already established. Reference is made in this article as elsewhere in MODERN PLASTICS *magazine to plastic plywood since the urea-formaldehyde and phenol-formaldehyde resinoids are the bonding materials which have made modern plywoods possible.*

PLASTIC plywood is as much a part of everyday life as is the bed in which you sleep and the table at which you sit. Yet numerous as are its uses, few people beyond those directly engaged in its production and utilization are even aware of its presence, much less its importance in the business and family life of the nation. The cases of the finest grand pianos made in the world are all of hardwood plywood. Wherever wide surfaces, either flat or curved, are used on fine furniture, plywood yields perfect results without sacrifice of durability or beauty. This holds true for the top of the small but exquisitely inlaid occasional table, or the large, pretentious dining table. The unusual wood figures prevalent in bedstead design could not be produced were it not for this application of hardwood plywood. Drawer fronts, sides and tops of dressers and commodes, particularly in the better grades of furniture, are of plywood. To the furniture industry, this is an indispensable construction material. The paneled walls used so effectively in office buildings, hotel lobbies and other public places are sometimes plastic plywood, as are the cabinets, counters and showcases in the stores you frequent. The reason for this extensive use is based on: durability and practicability.

The durability of plastic plywood is of first importance. By its construction, it overcomes the natural tendency of wood to swell and shrink across the grain—a tendency which cannot be controlled in solid lumber and which is revealed in the deep checks and splits sometimes developed where solid lumber is used. Well-made plastic plywood can be relied upon to endure permanently.

The ease with which plastic plywood panels can be worked, their ability to support face veneers of unusual grain, their availability in almost unlimited sizes and their extreme structural strength mainly accounts for their widespread application. In plastic plywood, one tree of fancy figured wood can produce the entire panelling for one or more rooms, whereas a single wall of a large room would otherwise be its limitation. The fabrication of conventional plywood isn't a new art. Practiced through a hundred generations by the master craftsmen of civilization, it was the medium through which the ancient Egyptians constructed their imperishable sarcophagi. Chippendale, Sheraton, Duncan Phyfe and all the other furniture craftsmen of the 17th and 18th centuries availed themselves of the wonderful opportunities it offered in the fine decorative handicraft for which they are noted. However, as with all other

* U. S. Plywood Corp.



PHOTOS, COURTESY U. S. PLYWOOD CO. 1

2

1—Rotary cutting continuous length Douglas Fir veneer. 2—Close-up end view with arrow indicating position of cutting blade in rotary unit. 3—Machine for cutting plys to required dimensions for laying up prior to hot pressing. 4—Plys being passed through roller dryers for conditioning before applying resinous adhesive. 5—Mechanically spreading bonding resin over veneer surface. 6—Hot plate 16-opening press which provides required heat and pressure for hot pressing plastic plywood. Shaded area denotes position below floor level

3

4

mediaeval crafts, modern engineering and scientific achievement have so improved the technique of plywood manufacture that despite the remarkable skill of the masters, modern plastic plywood compares with their product much as the modern ocean liner compares with the Roman galley. It has been made possible through the development and adoption of synthetic organic bonds.

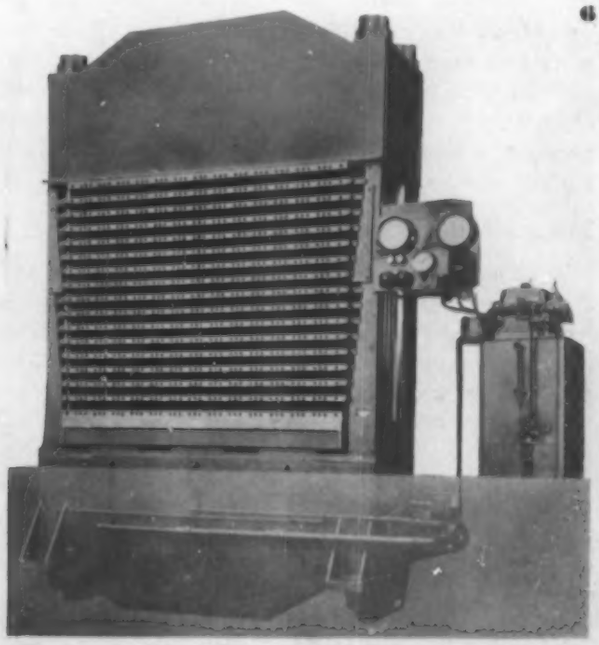
Scientists have applied their knowledge to fathom the intricacies of wood structure. Engineers have devised precision machinery with which to take advantage of the knowledge that science has revealed. Chemists, notably during the past twenty years, have devoted their efforts to the perfection of modern bonding agents. Their combined efforts have enabled the modern plywood mill to produce a quality product up to a standard of durability that seemed impossible only a few years ago.

Lumber for plastic plywood is cut in thin sections then molded into a unit under heat and pressure using a glue or synthetic resin for bonding. In its manufacture, the inherent deficiencies of wood are overcome, at the same time full advantage is taken of wood's characteristic strength. By nature, wood is exceedingly strong and stable along the grain (in the length) but substantially weaker and prone to movement across the grain (in the width). The familiar swelling and shrinking of wood due to fluctuation in its moisture content is practically confined to its width and is all but non-existent in its length. Likewise, wood splits in the width but not in the length. This basic difference in directional strengths is the fundamental principle of plywood fabrication. In manufacture of plastic plywood, 3 or more layers of thinly sawn, rotary cut or sliced wood are bound together with resinous adhesives, the plies being placed with their grains at right angles to each other. Bonded by the adhesive, the tendency of each ply to move across the grain is arrested by the solid resistance of the long grain in the adjoining ply or plies. As a result, the plastic plywood panel is equally strong in all directions, has a very low coefficient of expansion and does not split. The same characteristic balancing of one grain against the other accounts, too, for the remarkable ability of plastic plywood to hold fastenings. Nails, screws or rivets do not split plastic plywood, the successive plies bracing each other and preventing the separation of their respective fibers.

Plastic plywood can be produced in infinite types of construction by varying the number of plies and the type of adhesive, the thicknesses and the woods utilized. Typical construction calls for five plies, built up from a center ply (the core) set between two sheets of cross-banding and two sheets of face veneer. Core and cross-banding provide structural strength and tightly grip the varied fibers of the face veneers. Faces are selected primarily for their beauty, from the rarest and most unusual logs, but they are as important structurally as they are ornamental, and play an important part in the stability of the panel. Faces are cut in thin veneers varying in thickness from $^1/_{85}$ in. to $^1/_8$ in. Standard face veneers in fine hardwoods are generally cut $^1/_{28}$ in. thick. Birch and other more utilitarian woods are generally cut $^1/_{20}$ inch. In some rare instances, thicker faces are specified on the theory that heavier faces produce better plastic plywood. But the reverse is ordinarily true—the thicker the veneer, the greater its tendency to inherit the defects of lumber—defects which plastic plywood is designed to overcome. Thickness of core and cross-banding varies greatly depending on the size, type and structure of the panel, for plastic plywood is not only decorative but is relied on

5

6



7

8

7—Sanding machine with 8 drum endless belt sanders for finishing plastic-plywood. The unit is capable of finishing to close dimensional tolerances. 8—Small boat hull formed of plastic plywood

to give strength to the structure of which it is a component part.

In fabricating hardwood plastic plywood panels, exacting care is exercised at every step. Since faces are chosen for beauty (which frequently means unusual grain), cross-banding and core are specially selected to counteract any tendency toward distortion in the faces.

In the hands of the engineer or designer, hardwood plastic plywood rivals steel in strength, on the basis of weight. By varying the number of plies, the species of wood and the adhesive, plastic plywood can be produced which, pound for pound, is stronger than the finest steel. This unusual characteristic can best be explained by comparison with multiple-ply automobile tires or the huge steel cables from which the world's greatest bridges are suspended. Thus, in a 4-ply tire, the strength of the tire fabric is far greater than the total strength of the four plies taken individually. The strength of the 1000-strand steel bridge cable is several thousand times the strength of any individual wire in that cable. Engineers, furniture designers, cabinet makers—all those who direct the use of plastic plywood, take advantage of this important quality in building lighter weight but stronger jobs.

The manufacturing process

The manufacture of plastic plywood possesses never-ceasing interest even to those intimately associated with its processes. The variety of constructions, types of wood and methods of development are infinite and present and ever-chaning picture. Plastic plywood manufacture divides itself naturally under four headings:

A. The cutting of veneers.
B. The supply of cross-banding and core stock.
C. The adhesives and bonding agents.
D. Panel assembly and pressing.

Of these, veneer cutting is probably one of the most intriguing as every fresh log brought to the veneer mill is something of a mystery until it has been cut. Only the band saw, the lathe, the slicer or the veneer saw can confirm or contradict the log purchaser's judgment.

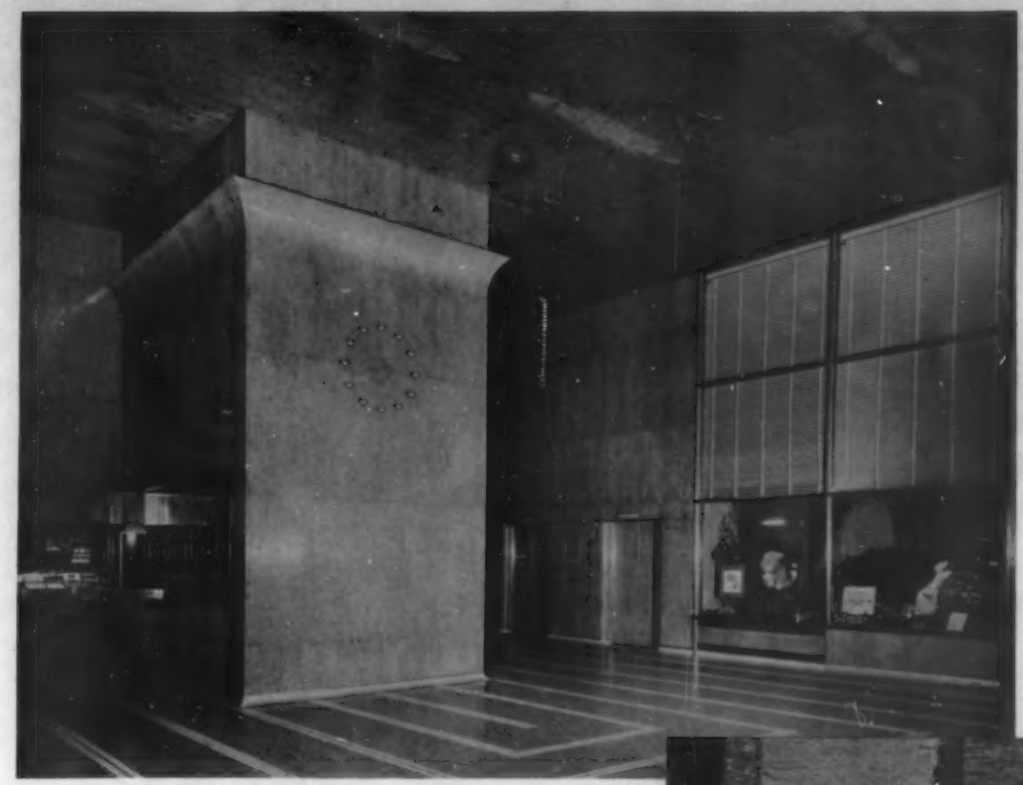
Market requirements and the character of the log determine to which type of veneer cutting the log will be subjected. There are six of these types:

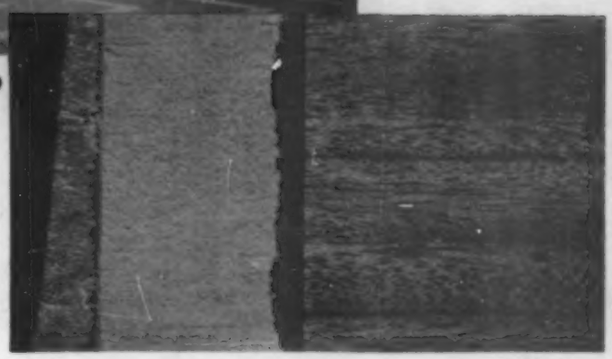
1. Rotary Cutting.
2. Half-round Rotary.
3. Flat Slicing.
4. Quarter Slicing.
5. Back Cutting on Rotary Lathe.
6. Sawing.

In preparation for cutting by either of the first five methods, the entire log or sections of it are either cooked in boiling water or steamed for periods of from a few hours to several days depending upon the nature and hardness of the wood and the nature of the sap. There are several exceptions: Poplar, Basswood, Cucumber and several other woods are cut cold. Logs to be prepared for sawn veneers, are not treated.

Logs best suited for Rotary and half-round are selected in the log yard. With logs selected for slicing, back cutting and sawing, a preliminary cut through the center of the log gives the flitcher a complete picture as to the real character of the figure. His experience and judgment often determine the type of cutting and the angles at which the cuts are to be made. The nature of the veneer figure depends on his decision. Faulty judgment may result in the production of an average or poor figure from a prized log. Good judgment enhances the log's value tremendously.

Rotary Cutting: This is the oldest and most common method of veneer cutting by "knife." The entire log is mounted on a lathe and turned against a pressure bar and a knife with a razor-sharp edge. The operation is similar to unwinding a roll of paper—as the log revolves the veneer is peeled off in a thin, uniform sheet. Rotary cutting produces a swirly, variegated grain marking due to the knife edge travelling more or less along the





arc of the annular growth rings in the tree. Rotary veneer can be produced in extremely large widths, yielding matched-veneers, as well as one-piece faces.

Half-round Rotary: This is similar to rotary cutting except that the log is placed off center in the lathe. As the blade cuts through the annular rings off the line of their arc of growth, the figure is much milder and adjacent sheets yield a symmetrical pattern when matched.

Flat Slicing: In this method of cutting, each half of the log is first trimmed to a hexagonal shape to eliminate all bark and unsound wood. These sections are referred to as "flitches." After steaming, each flitch is clamped horizontally to the stay plate in the veneer cutter. The stay plate moves vertically against the veneer knife, which, at each down stroke, slices from the log a veneer of the desired thickness and the full length of the flitch.

Quarter Slicing: This is the most expensive of all veneer knife-cutting methods. The actual cutting of the veneer is performed exactly as in flat slicing, the difference being in the preparation of the log which, instead of being trimmed (*Please turn to page 88*)

PHOTO, COURTESY DUREZ PLASTICS & CHEMICALS, INC.

9—Foyer U. S. Rubber Building, Rockefeller Center, New York, with walls of Robertson metal.* 10—*Detailed view of wood veneer bonded to metal using cloth and resin for adhesive.* 11—*Palace automobile trailer with walls of Douglas fir plastic-plywood which adds both strength and stability to the model

1

Building by squares

Injection molded polystyrene tiles create new effects for interior wall installations

OUT of the kitchen and bathroom into smart display rooms come richly colored tiled walls of new molded polystyrene blocks. Injection molded in 6 standard colors, the tiles are 6 in. square. Easily assembled or dismantled they offer a new design and architectural medium with potential applications for hotel and theater lobbies, reception rooms, cafes, bars and restaurants, stores and commercial interiors. Of course, their suitability for home use in modern kitchens or baths is unquestioned.

The tiles are meant to be used for decorative effects rather than structural, for this reason they are noncompetitive with glass brick. The color, of course, goes all the way through and each tile possesses all of the good qualities of polystyrene, such as good dimensional stability, resistance to moisture, acids, alkalies, alcohols, cleaning solutions, normal and above-normal temperatures. Easily cleaned with soap and water, they will retain their rich, lustrous appearance.

The construction of walls with these tiles is greatly simplified by the shape and design of the individual blocks. Each tile is essentially an open-bottomed box. The top of this box-like shape forms the wall surface. In the sides of each box-like tile there are holes, and in temporary installations or in cases where the rear of

2

the wall is accessible, the tiles are simply clipped together as they are laid up. The lining up of the holes assures a smooth, even surface. A different method is used in permanent installations. The face of each tile has a set-back around the edge. When the blocks are laid up, these set-backs form interstices. Special cements placed in these interstices weld the entire wall into one integral section of exceptional strength and rigidity. Another method of installation has been to place the tiles in a soft plaster wall in much the same way as ceramic tile is set. This type of installation is possible where rear illumination is not required.

The colors of the tiles are distinctly attractive. In addition to the standard solid colors, several variegated designs are possible. While no conscious attempt is made to ape natural materials, some of the effects recall warm, richly colored stone. In certain installations, added effects are possible by lighting from the rear with either incandescent or fluorescent lamps. Thus it is possible to make the walls serve as the source of room illumination. In many places where general illumination for reading is not required, the need for a basically different method of illumination has long been noted. The soft translucency of these tiles is considered to be an important step in the solution of this problem. Lighted from behind, a wall of the tiles can be converted into a soft, pleasing surface from which the light gently floods the room. The brightness and harshness of some point sources of light are thus obviated, while a totally different concept of interior lighting is made possible.

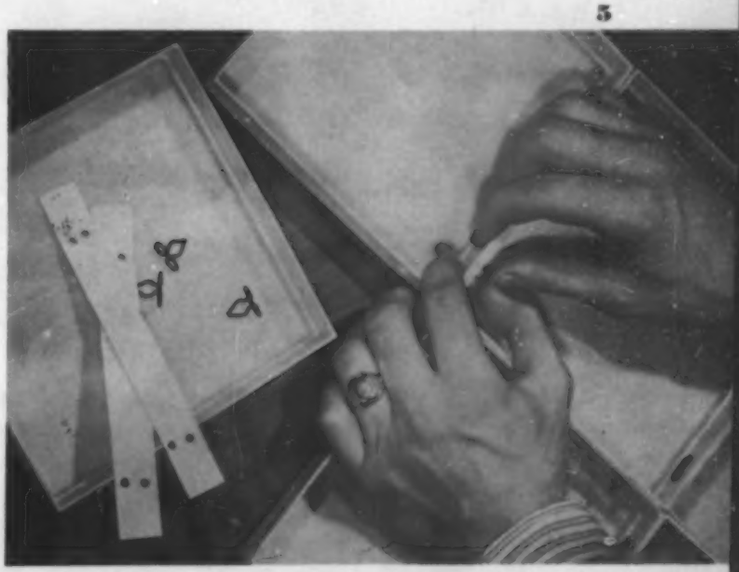
Each tile is injection molded with 2 gates, one on each side, thereby assuring distinctive flow lines in the mottled colors. Each unit weighs about $3^3/_4$ oz. and although they are, at the present, being produced in only one size and shape, it is believed that as demand increases, so will the designs and sizes. The tiles are easily and quickly installed and just as readily dismantled. This is important to the display people who like materials that can be re-used for backgrounds and various display settings.

What the architects and interior designers will do with these plastic tiles remains to be seen. We may not be far wrong in conjecturing that many will prefer a mat finish to the smooth, shiny surface of the units now on the market. And as for incorporating these sleek, modern tiles into an interior that is done in a period style, well, that, too, is undoubtedly a matter of personal opinion. The tiles have real merit and a host of possible applications in definite fields.

Credits: Lumitile by Cooperative Displays, Inc., molded of Monsanto Lustron by Recto Molded Products, Incorporated.

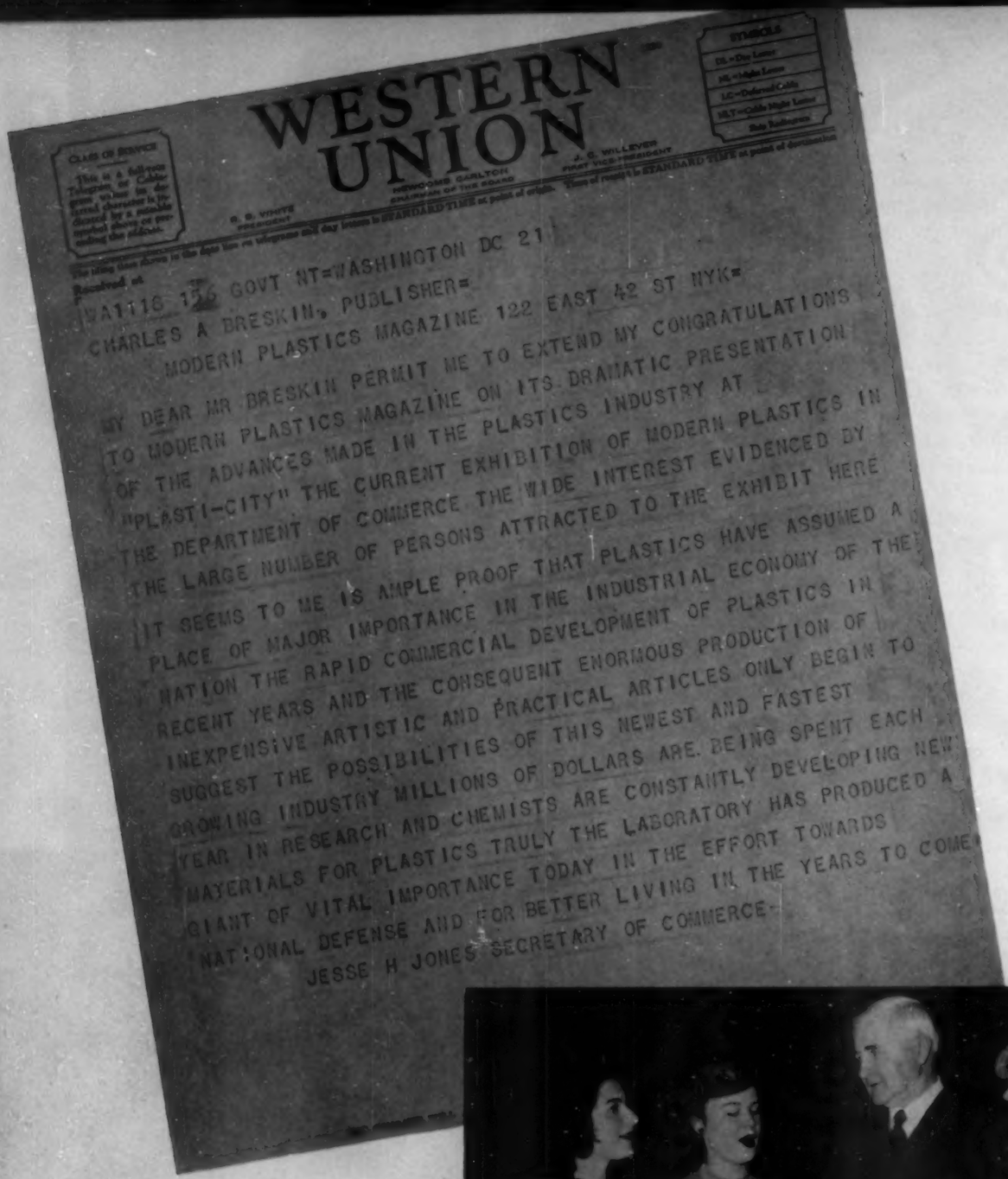
1—*Walls made of colorful Lumitile can be illuminated from the rear with either incandescent or fluorescent lamps thus flooding the room with a soft, glowing light.* **2**—*Sturdy, lightweight and permanently finished, the tiles are available in 6 standard colors—fire-red, canary-yellow, American-blue, opal-white, aqua-green and sky-blue. Ideal for display work, these 6-in. sq. units are easily installed, readily dismantled and can be used over and over.* **3**—*A section of an eye-catching display paneled with plastic tiles.* **4, 5**—*One method of assembling the tiles is by the construction of a light wood frame with protruding straps of metal. Tiles are clipped together with the patented clip arrangement into panels of various sizes, then fastened to the straps with the same clips*

5



3

4



WESTERN UNION

CLASS OF SERVICE

SYMBOLS

DL=Day Letter
NL=Night Letter
LC=Deferred Cable
NLT=Cable Night Letter

R. B. WHITE PRESIDENT

NEWCOMB CARLTON CHAIRMAN OF THE BOARD

J. C. WILLEVER FIRST VICE-PRESIDENT

Time of receipt is STANDARD TIME at point of destination

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin

Received at

WA111G 126 GOVT NT=WASHINGTON DC 21

CHARLES A BRESKIN, PUBLISHER=

MODERN PLASTICS MAGAZINE 122 EAST 42 ST NYK=

MY DEAR MR BRESKIN PERMIT ME TO EXTEND MY CONGRATULATIONS TO MODERN PLASTICS MAGAZINE ON ITS DRAMATIC PRESENTATION OF THE ADVANCES MADE IN THE PLASTICS INDUSTRY AT "PLASTI-CITY" THE CURRENT EXHIBITION OF MODERN PLASTICS IN THE DEPARTMENT OF COMMERCE THE WIDE INTEREST EVIDENCED BY THE LARGE NUMBER OF PERSONS ATTRACTED TO THE EXHIBIT HERE IT SEEMS TO ME IS AMPLE PROOF THAT PLASTICS HAVE ASSUMED A PLACE OF MAJOR IMPORTANCE IN THE INDUSTRIAL ECONOMY OF THE NATION THE RAPID COMMERCIAL DEVELOPMENT OF PLASTICS IN RECENT YEARS AND THE CONSEQUENT ENORMOUS PRODUCTION OF INEXPENSIVE ARTISTIC AND PRACTICAL ARTICLES ONLY BEGIN TO SUGGEST THE POSSIBILITIES OF THIS NEWEST AND FASTEST GROWING INDUSTRY MILLIONS OF DOLLARS ARE BEING SPENT EACH YEAR IN RESEARCH AND CHEMISTS ARE CONSTANTLY DEVELOPING NEW MATERIALS FOR PLASTICS TRULY THE LABORATORY HAS PRODUCED A GIANT OF VITAL IMPORTANCE TODAY IN THE EFFORT TOWARDS NATIONAL DEFENSE AND FOR BETTER LIVING IN THE YEARS TO COME

JESSE H JONES SECRETARY OF COMMERCE-

2

1—Jesse Jones, United States Secretary of Commerce, expresses his appreciation of the importance of plastics in a wire to Mr. Breskin apropos of the opening of Plasti-City. 2—Attending the opening day ceremonies, Mr. Jones posed with some of the professional models who gave the visitors an idea of "the shape of things to come" in plastic wearing apparel. Other views of the extensive exhibit are shown on the following pages

Plasti-City, Washington, D. C.

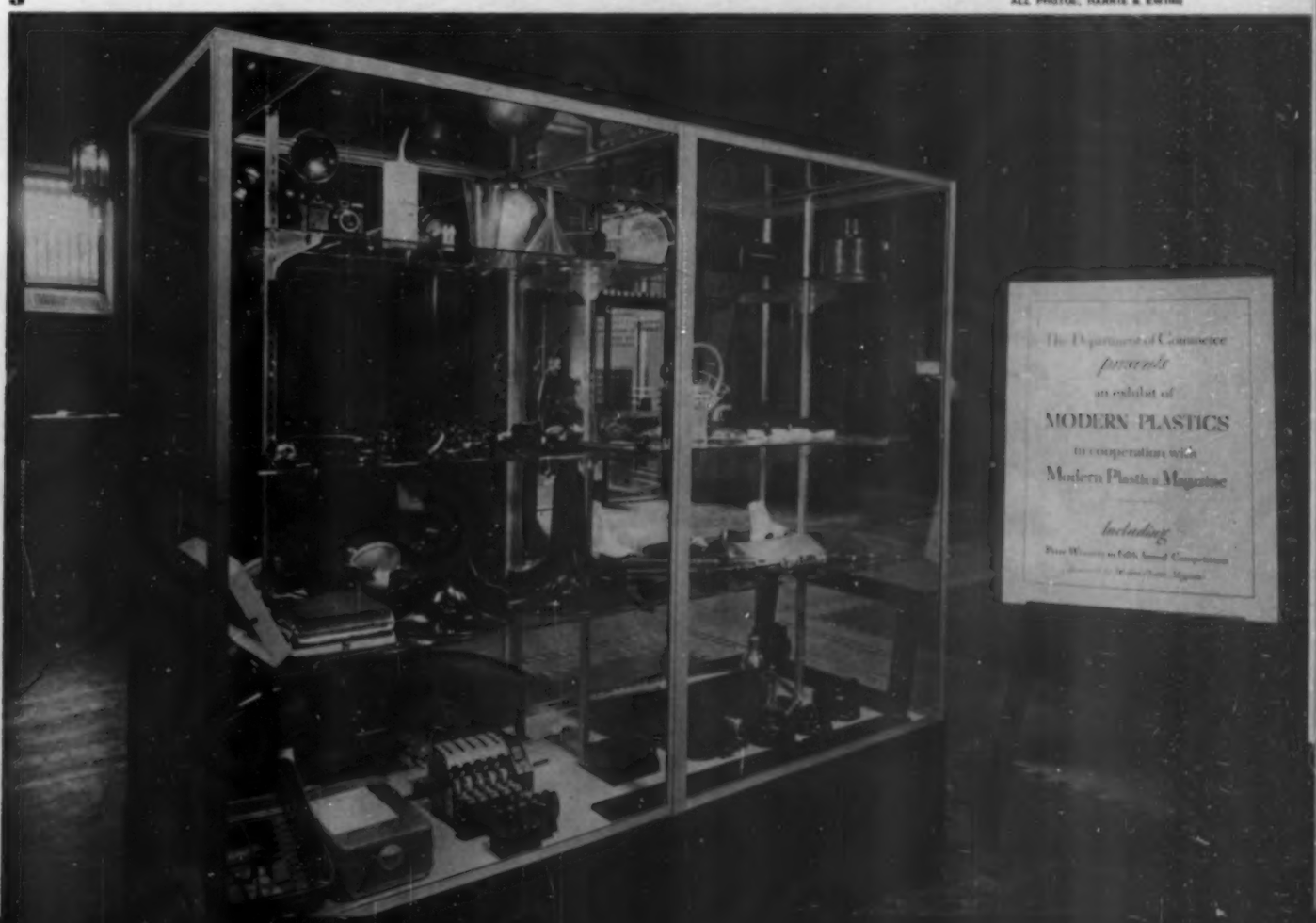
Series of nation-wide exhibitions makes its debut in the Department of Commerce Building

NEWSREEL cameramen and the press were out in full force to cover the opening of *Plasti-City*, a plastics exhibit, sponsored jointly by MODERN PLASTICS magazine and the Chemical Division of the Department of Commerce in the foyer of the Department of Commerce Building on December 16. Launched by Jesse Jones, Secretary of Commerce, the exhibition which extends through to February 1, represents the most extensive and dramatic display of plastics ever held in Washington. The award-winning entries from the Fifth Annual Modern Plastics Competition are a feature attraction. Highlights on the opening day included a style show of plastic clothes and accessories worn by professional models, the sound and color film, *The Magic of Modern Plastics*, and the distribution of molded Bakelite measuring spoons as souvenirs to all visitors.

Virtually every phase of American life from household appliances to national defense preparations, is represented in the exhibit. The clothing and accessories modeled at the opening ceremonies now form one of the permanent displays. Because of the widespread interest in national defense, special attention is devoted to this field where several new developments of importance in aviation, ammunitions and chemical warfare are on display. A whole room furnished in plastic pieces dramatically illustrates the extent to which the industry has gone in the direction of architecture, interior design and decoration. Men will be interested in the illustrations of plastic applications in the aeronautic and automotive lines, as well as the wide variety of sporting goods and accessories now being made of various types of plastics.

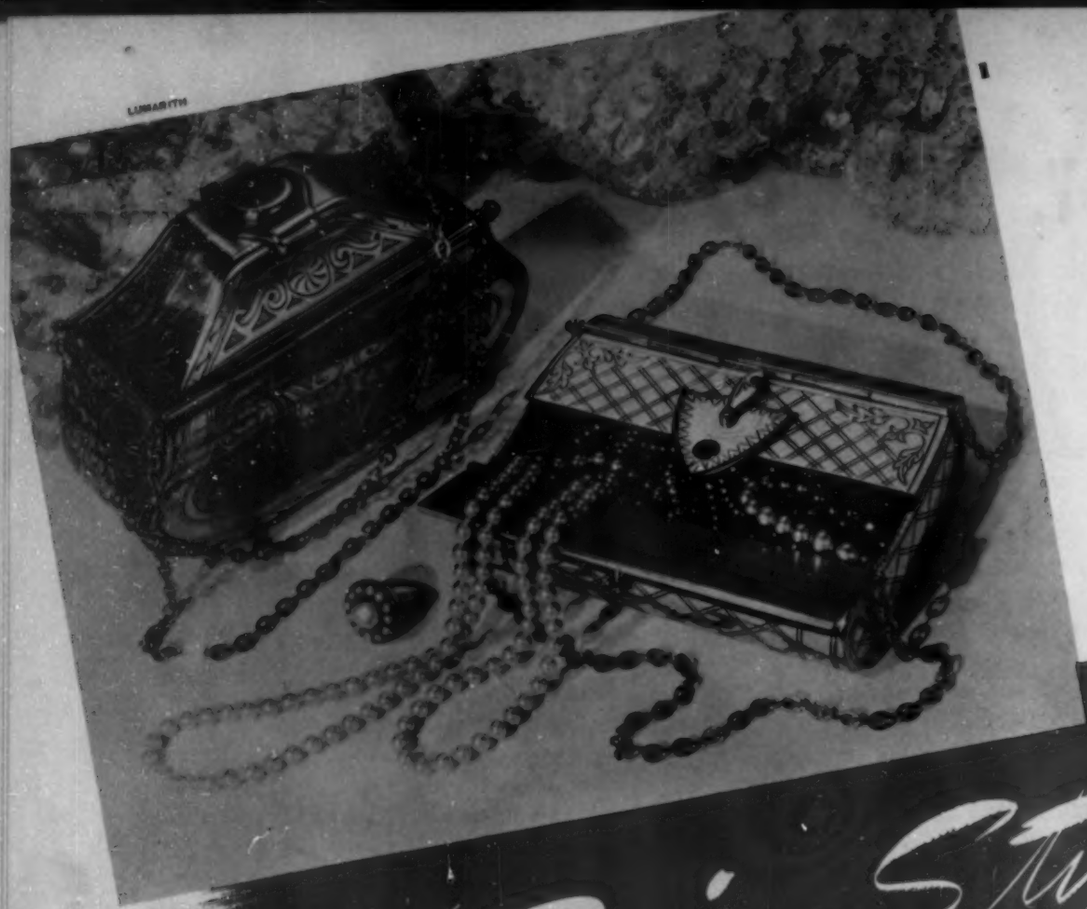
Reports from Department of Commerce officials tell us that crowds have been streaming through the exhibition ever since the opening day. Plans have been made for conducted tours for school and college chemistry classes at which experts of the plastics industry will explain the origin and processes involved in producing the various articles shown. Raw materials, molding powders, preforms, sheets, rods and tubes of various types of plastics serve to show (*Please turn to page 86*)

ALL PHOTOS, HARRIS & EWING



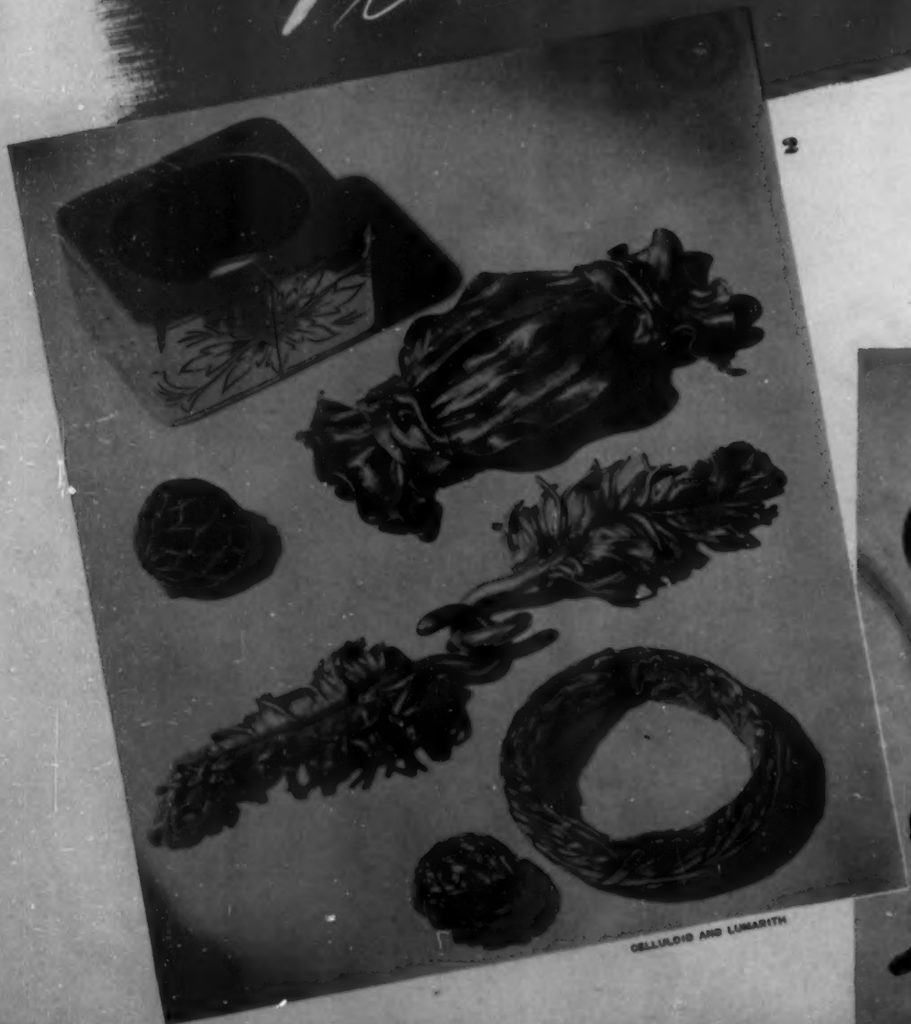
LUMARITH

1



It's in Style

2



CELLULOID AND LUMARITH

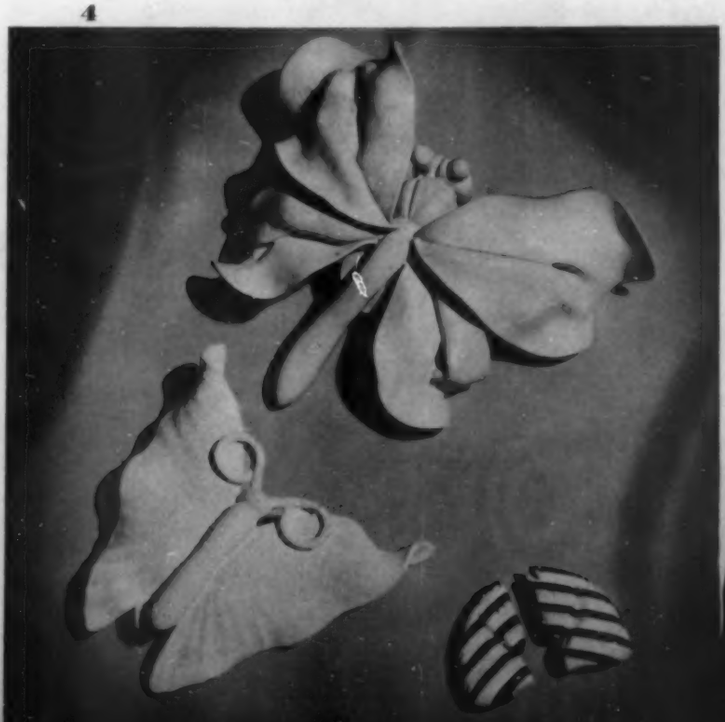
3

PLASTICS continue to make themselves known and felt in the style and fashion world with applications that have climbed from the inexpensive, mass production items to the exclusive, one-of-a-kind group. At the recent annual Congress of American Industry, the National Association of Manufacturers Fashion and Science Show presented an array of costumes all made from synthetic textiles. Highlights in the fashion parade were a nylon black velvet dinner dress trimmed with the same material in a gold color and accented by a matching, up-swept turban and shirred muff-bag trimmed with acrylic. A gray, mannish suit, smartly tailored, gave no hint of its casein origin, while a vinyon swim suit, a housecoat made from soybean fiber and a gown woven of metal foil and laminated with cellulose acetate film all gave a fair indication of the "shape of things to come."

Some interesting new jewelry, evening bags and jewelry cases have been appearing in the windows of the smart, upper Fifth Avenue shops, and tracking them down, we find that all of these lovely creations are from Ardor of Paris. This firm is run by the four Wahl brothers, designers who have supplied buttons and trimmings and accessories to such story book names as Schiaparelli, Mainbocher and Molyneaux. They work with cellulose acetate and cellulose nitrate employing the mechanics of plating on plastics to secure unusual effects. Plating of plastics is, of course, not new, but the workmanship, designs and certain little trade secrets have helped the company to turn out pieces that are unique. Let us trace the steps involved in the making of one of the gold-plated plastic jewel cases (**1**). The plastic sheets are supplied in a 20 in. by 50 in. size, generally in a neutral shade, such as gray. The component parts of the bag are blanked out using the general type of automatic press. These parts are then formed in hot presses using heated dies. The designs are deeply carved into the plastic so as not to be obliterated by subsequent plating, and the integral units are then ready for assembly. The surface to be plated is given a coat of varnish, and while still tacky is sprayed with a fine coat of finely divided conducting agent, such as powdered bronze or graphite. This provides an electro-conducting surface to the parts to be plated only. Thus the gold plate is not wasted on the inside surface. Electrical contact is then made by means of wire to the coated surface. An acid bronze stop bath is next used to prevent breakdown of the coating. This may be followed at once by the copper plating procedure used with any ordinary metal, transferring the copper from master electrodes into solution and redepositing on the jewel box. The unit is then polished to remove uneven plating caused by the variance in conductivity of the plated film. Fourteen karat gold is plated on in the same manner, sometimes using a substrating coating of another basic metal. Polished and lacquered with a special lacquer, the lining and final dressing-up finds an exquisite jewel case that is lightweight, and non-tarnishing.

This method of plating or lacquering over plastics is employed consistently by this firm. Some of the effects are extremely lovely, dull gold covering exquisitely shaped accessories (**2**). The smaller bracelet, incidentally, with the matching button is made of celluose acetate "spaghetti," or shavings, softened in hot water, formed and then plated. The amber-colored snakey-looking necklace (**3**) is made from rod stock, and carries an over-all carved detail. Where it curves around the neck, the rod is broken and threaded with an elastic cord to give it flexibility. The bow pin

4

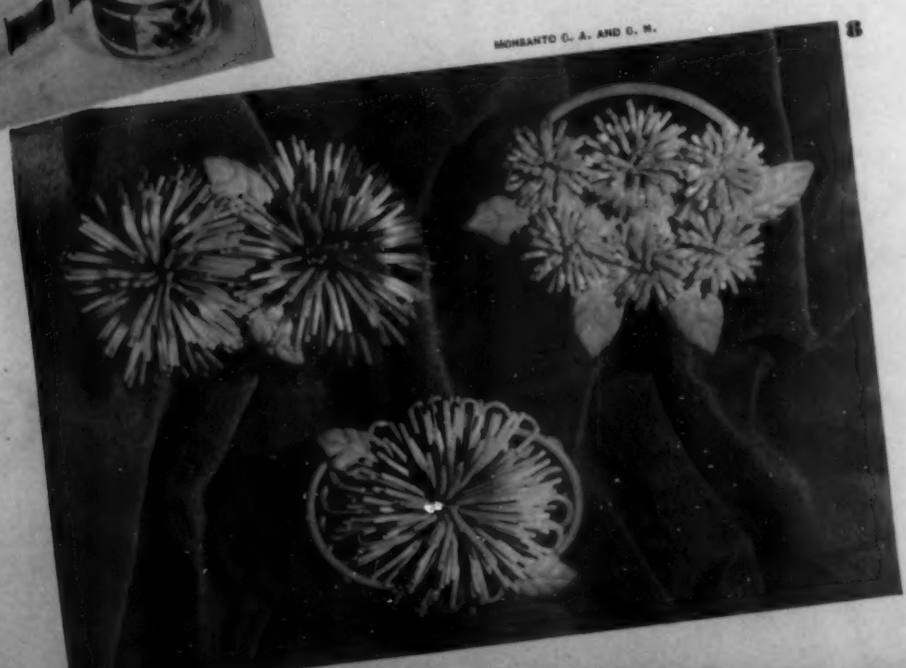


5

in this same group is gold plated. These pins are available in gold, nickel and copper colors and are sold over the counters of the five and ten. Butterflies and a zebra buckle (**4**) represent more of the craftsmanship of Ardor of Paris. The larger butterfly is a very pale aqua with a smooth, satiny finish, while the smaller one is chalk-white and rough in texture. The black and white zebra buckle is very good looking and is made by cementing black and white pieces of cellulose acetate material together.

Louisesanders has introduced highly plasticized vinyl material into the millinery world with several dramatic applications of the extruded and sheet form. Crocheted clear strands of the plastic form the entire brim of this little hat (**5**). Combined with navy which forms the crown and bright red poppies made of the vinyl sheet material, the hat is complemented by a chain necklace of gold links softened by a crocheted edge of the plastic. Throughout here collection for resort wear, Miss Sanders has made extensive use of this plastic for trim. On this wide brimmed, white Shantung hat (**6**) the plastic, in white and emerald tones is used in knotted swirls that form a draped band and a fringed side trim—a stunning model for dressy daytime or tailored frocks. Notice the necklace and gloves of this ensemble—the plastic in the same colors lends effective and pleasant harmony to the outfit.

If you are following a current style trend, then you are patriotic in all that you say and do—and wear! Here is a collection of belts (**7**) that will make you more conscious than ever of this precious Western Hemisphere of ours. Made of clear cellulose acetate, they are exquisitely enameled by hand with a variety of patterns and symbols for sports and cruise wear by Lorraine Leland. Among the designs now available are the Pan American, all the flags of the American nations, both North and South, the Undersea Marine Life, the Cruise, inspired by Southern cruise enchantments, Mexico with all the characteristics the "Yanquis" have grown to love, and a charming "Children at Play" design inspired by an old French print. The



colors are clear, and the technique differs from anything done in this medium. There are bracelets to match.

Costume jewelry in a different manner (**8**) finds cellulose acetate and cellulose nitrate materials—pearly green and delicate pink—cut to form interesting spray patterns that are superimposed on leaves of the same, colorful, non-tarnishing material. Additional touches are added by rods, formed into intriguing scallops.

An engineer of American handbags, Josef of Gold Seal Importers, has designed a panther-black suede bag (**9**) coifed with a Medici collar of methyl methacrylate, hand-carved on the under side so that it sparkles like cut crystal. The fine designing of the bag is evident in the detail and construction—soft folds, a practical, well-fitted interior, and the width to which the bag opens. Josef has designed a magnificent collection of handbags, trimmed, clasped or framed with this plastic.

Unique in the utter simplicity of the design, a new line of compacts has recently been introduced by Henriette, Inc. (**10**) in which plastics are playing a stellar role. Molded of transparent acrylic resin, the compacts are, at present, available in tortoise, clear, tourmaline (pink), sapphire, ruby and blonde amber. Thick walls give a feeling of sturdiness and richness.

Suspenders, garters and belts (**11**) are now being made of an extruded vinylidene chloride plastic. Extruded in various gages and in a wide variety of rich colors, the patterns possible through weaving are limitless. Easily cleaned, strong and resistant to acids, alkalies and virtually all solvents, accessories made of this material are bound to find wide favor.

10

CRYSTALITE, LUCITE

11

SARAN

9

LUCITE

SHOWER CURTAINS

Like billowy curtains of mist, the new type of shower curtains made of vinyl plastic sheeting are helping to brighten up bathrooms throughout the land. These curtains contain neither rubber, oiled silk, nor woven fabric, but are plastic sheeting all the way through. Since they are not a coated material, they will not peel, crack or stick together or to other materials. Waterproof, they will not rot or mildew. Soapy water will not leave stains, and finger and dirt marks may be wiped off with a damp cloth or sponge. The texture of the plastic material allows it to hang straight and smooth, so that it does not blow about in the shower nor wrap around the body. The curtains may be washed by swishing about in warm suds, rinsing in clear water, and hanging without ironing. This plastic fabric has a silken sheen in both the transparent or slightly opaque colors which gives added luster to the many beautiful shades in which the curtains are available. Besides a true coal-black and a clear crystalline tone the curtains come in other lovely shades and three different sizes: 6 ft. by 6 ft., and 9 ft. by 6 ft., and 3 ft. by 6 feet.

Credits: "Krene" a vinyl fabric distributed by National Carbon Co.; Distribution is limited at present.

PRODUCT DEVELOPMENT

MUSIC WITH LIGHT

Youthful musicians of Fromberg High School, Fromberg, Mont., believing a band should be seen as well as heard, have strikingly adapted the optical properties of methyl methacrylate resin to achieve that end. All band instruments, and even the batons of three drum majors, who perform in unison, are outlined with rods of the crystal clear plastic. They provide an impressive colored lighting effect as the band marches at night or plays in a darkened auditorium. Each rod is formed to the shape of the instrument and fastened on with transparent tape. On clarinets and saxophones, small superstructures of wood hold the rods in position. The rods are illuminated by tiny flashlights, each instrument obtaining its individual lighting effect. The light bulbs are placed at the end and the glow transmitted throughout the length of the rod by the plastic's property of internal reflection. Each of the 30 musicians also wears a hat decorated with the glowing material. In all, 110 bulbs and batteries are required. The transparent plastic rods look like the finest glass. They are almost shatter-proof and the weight of the instrument is increased only slightly—important to the band's "twirlers," who send their batons whirling high in the air to create solid wheels of flashing light.

Credits: Designed with Lucite by Glenn Reddick.

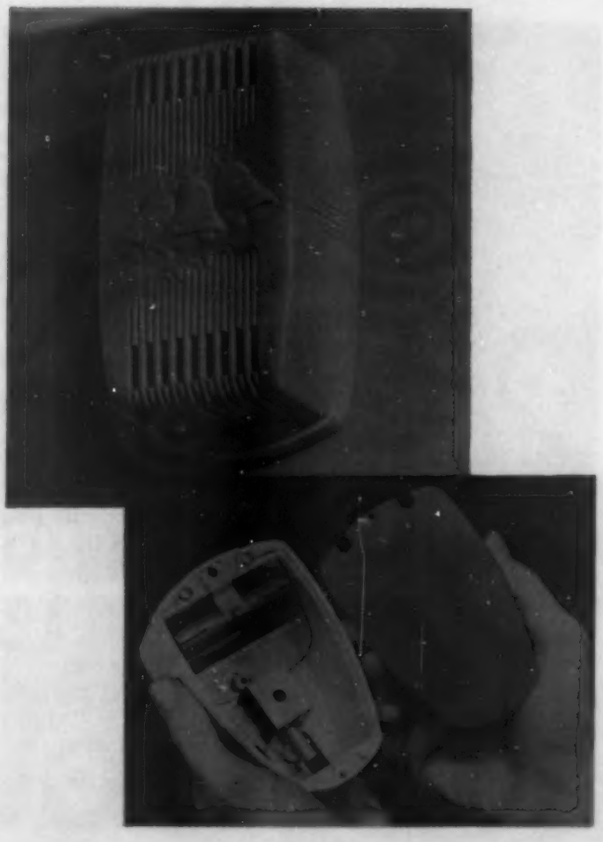
CATALOG COVER

Those who have been subjected to the yeoman work of collecting and preparing material for a catalog know the importance of selecting a cover that will live as long as the content of the book itself. Catalogs usually undergo a great deal of handling. They are works of reference which means that their job never ends. Plastics are now helping catalogs to keep a stiff upper lip! Injection molded acetate butyrate covers with raised lettering and decoration are exceptionally strong and are said to outlast those made of ordinary fabric and leather. In designing covers of plastic material, economy as well as novelty and wear was the objective. Cover replacements are often necessary if a catalog is to retain its neat appearance, and this is not only costly but a nuisance as well. The use of a plastic catalog cover has solved these problems. The fact that letters and designs can be etched right into the mold eliminates stamping, embossing and tooling operations. The covers will not dent, crack or tear; corners will not break or bend. Lustrous and smooth in its surface finish, the original beauty will not be damaged by constant handling. Colors will not wear off—what's more, the covers can be quickly and safely cleaned by wiping with a damp cloth. The color range

is practically limitless—solid and variegated tone color.

Credits: Tenite II molded by Belmont Molded Plastics, Inc., for the Chas. W. Breneman Company.

PRODUCT DEVELOPMENT



DOOR CHIMES

Door bells that ring with a harsh, piercing cry and cause one to go to the door trembling with fright at having been aroused from the peacefulness of the household, have given way to mellow chimes that have a pleasing sound. Door signals have been changing with great rapidity during the last few years from the long-used vibratory bell-type to the chime tones. Chimes have been available in a number of different types, but practically all of them have been in the higher priced brackets. Plastics are now taking the place of the metal which was formerly employed as a housing for the mounted mechanism and tone bars. This chime, as it is made with the plastic case, is tamper-proof and is completely enclosed when installed, as the wiring terminals are on the outside of the case. All of the mechanisms and parts are firmly attached directly through holes or projections in the plastic housing. Because of the simplicity of construction and assembly, the chimes can be sold at very low prices. The design of the unit is kept simple, while the lustrous finish, washability and beautiful colors available in this material make it ideal for all types of wall finishes.

Credits: Beetle, molded by Marks Products Co., Inc., for Snapit Door and Signal Chime Company.

PENCIL SHARPENER

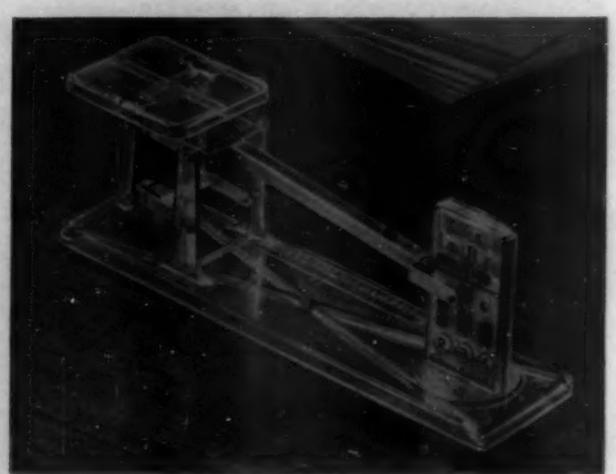
Gone are the days of the old-fashioned pencil sharpener that had to be turned with a hand crank and was always found in some obscure corner of the office, 'way out of sight. Now, a sleek, modern unit has appeared on the market, completely housed in plastics—either phenolic or urea. The material is molded, thus assuring faithful reproduction of all detail in distinctly defined lines, curves and contours. If a metal case had been used a special finishing operation would have been necessary, and it is doubtful whether an enamel finish would resist cracking, chipping and crazing that might come as a result of withdrawing the shavings drawer thousands of times and the jabbing of pencils into the orifice many times a day. This unit is a precision machine and because the plastics used allow little shrinkage or expansion, the parts will be true to the thousandth. As an electrically driven machine, the sharpener is extremely rapid in action thus entailing some vibration, but since plastic material is employed for the housing all noise is eliminated. The sharpener is entirely automatic; it has a large shavings container, it sharpens colored, soft lead pencils as well as pencils of different sizes.

Credits: Bakelite and Plaskon molded by Kurz-Kasch, Inc., for Triple "E" Products Company.

PRODUCT DEVELOPMENT

LETTER SCALES

Scales for weighing letters answer the question, "How much postage do you think this letter will take?" All of us have either asked the question or tried to answer it by holding the letter in our hand, wrinkling the brow, then naming some amount that might be right, but is more than likely wrong. Letter scales not only eliminate this situation, but by dispensing with guesswork, they effect an appreciable saving in postage. Such a stampsaver scale is the one molded in clear transparent and translucent green cellulose acetate. In this case, however, the unit is as attractive as it is efficient. It is small in size, lightweight and well designed. The tough and resilient characteristics of the plastic make it practically impossible to break the scale, while the luster and smooth finish are so much an integral part of the material that the wear and tear of constant handling and use have no detrimental effect. Like all cellulose acetate plastics, the scale can be cleaned with a damp cloth. Depressed letters with wiped-in color identify the three postage rates most commonly used: city, United States (out of town) and air mail. The scale weighs letters up to 3 ounces. A handy item for individual offices, this serviceable little scale is not out of place in any home. It is a good looking desk accessory



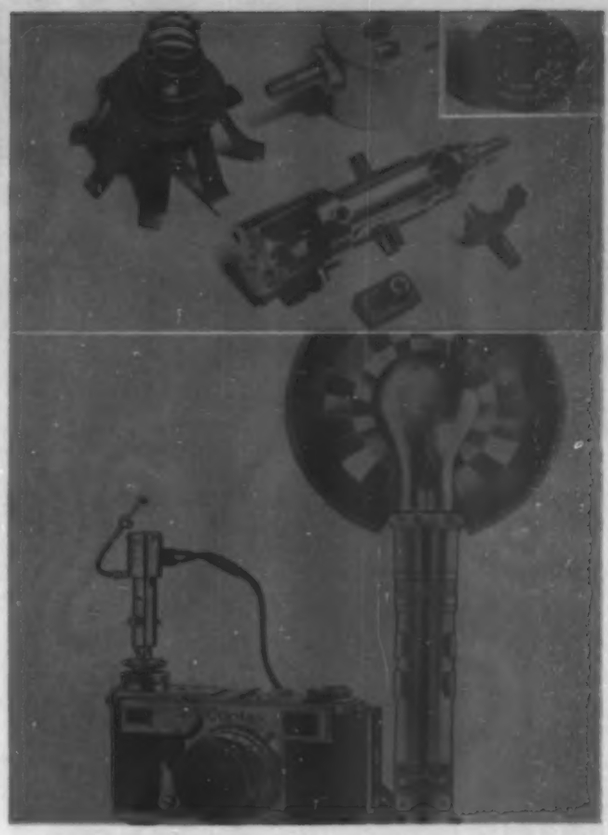
for library or study; in fact it might even find its way into the kitchen as well. Although kiddies in the house may exclaim with glee when they see this little unit, thinking it is a new toy, adults will know immediately that the scale is well constructed with a mechanism that performs real work. The unit is molded in 2 pieces: the base with the 2 upright posts and the indicator panel forming one part, with the letter table as the second.

Credits: Tenite molded by Modern Plastic Co. for Beverly Craft.

FLASH SYNCHRONIZER

Picture-shooters, those demon professionals or rabid amateurs, depend on precise smooth synchronization for spectacular man-made light effects. The Meteor-Flash, a new item for the photographer's kit, achieves this result by simply pressing the cable release for setting the shutter. The automatic safely retractable plungers allows setting the shutter for the next exposure even before the Meteor-Flash is set—or vice versa. Mechanically accurate, the synchronizer is insulated with tiny laminated plastic parts machined to extremely exact tolerances. Laminated fiber tubing, $^{7}/_{16}$ in. in diameter, cut to size is split to form tiny terminal blocks which provide insulation between plunger and terminal contact points. Small diameter laminated phenolic-fiber tubing protects wire in the base of the device. Other plastic parts are the contact nut, insulation disk on the "spider web" bulb socket, insulation washer and insulation bar on the adjustment screw. Accessories for the assembly include a connector block which joins attachments for firing two or three bulbs simultaneously or for fixing side lights. This is made of two laminated disks, riveted together, drilled, fitted and stamped.

Credits: Phenolite by National Vulcanized Fibre Co. Fabrication, Chardelle, Incorporated.

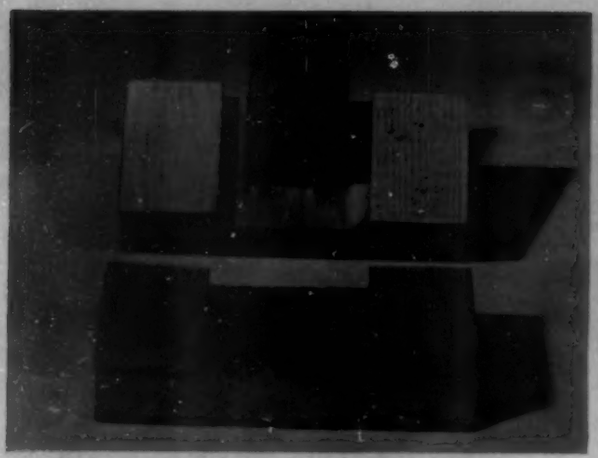


PRODUCT DEVELOPMENT

BED LAMP

Those who enjoy reading in bed will rejoice over the fact that the first "Better Light—Better Sight" bed lamp completely housed in plastics with a plastic diffusor, is now on the market, helping to reduce eyestrain by producing conditioned light. In ivory and walnut plastic, the lamp will harmonize with decorative schemes, and it is easy to keep clean. In the center of the molded lamp body is a rectangular, translucent, cellulose acetate shield which screens the raw light of the bulb and diffuses it evenly and unglaringly over the entire reading area. Because of this plastic diffusor, a standard 60-watt bulb can be used. The lamp is equipped with rubber-covered flexible clamps so that the unit can be attached to any type of bed. Smartly styled, this lamp combines the fine qualities of plastics with the best features of a scientifically correct reading lamp. The sturdy housing will not be affected by lamp heat and is permanently finished. The light switch is on the bottom, readily accessible to the user. The cord has a special dual outlet plug making it convenient for other electrical attachments.

Credits: Luxuray housing of Plaskon and Durez molded by International Molded Plastics, Inc., for Mitchell Mfg. Co. Plastacele lens.



1

2

3 PHOTO, COURTESY GLENN L. MARTIN CO.

1—Wet and dry tests made with various types of wood prove the superior qualities of this new glue. In this instance, the wood failed, but the glue held. 2—Two blocks of 1 in. thick rock maple were edge-glued together. Note the complete wood failure of the rock maple when impact pressure was applied. 3—The aircraft industry is demanding lighter yet stronger materials such as the plywood used in making this door for bombers. Fourteen ft. long, it weighs only 41 lbs. and is designed to bear more than 3000 lbs. of weight

Urea resin adhesives

by DR. M. H. BIGELOW*

FEW industries are changing and developing today as rapidly as the adhesive industry. If you have any affection for the long historical perspective, you can start as far back as four thousand years ago, and come up to the twentieth century with little or no change in materials and methods of gluing. But in this century, and especially since about 1914, changes have come fast and frequently. With each change has come an improvement in some direction. And the greater part of the improvements have been due to plastics.

After the many centuries when all glues were either animal or vegetable, the first truly revolutionary development came with the introduction of casein adhesives. That was about the time of the last war. Then, just as the depression was setting in, came the next broad step, with the phenolic resin glues. Currently today we have a third marked step, in the production of urea-formaldehyde adhesives. The following discussion is concerned with the latest such adhesive.

* Plaskon Co.

This confronts many industries with some radically new achievements and possibilities in gluing.

Some larger industries employ two types of adhesive —the hot press and the cold press type. Each type represents an innovation in adhesives. The hot press type, supplied in powder form, has a stability which is virtually permanent, and in this it is unlike the liquid urea-formaldehyde glues. The cold press glue represents a notable achievement in accomplishing a chemical reaction previously beyond reach. Adhesive of this type has been long experimented with, but the difficulty lay in the fact that the product went right on with the aging process until eventually it disintegrated. There seemed to be no way of getting around this. The chemists have, however, succeeded in controlling the hardening process and holding it at precisely the right point, so that it sets in what is actually a thin layer of genuine plastic, with all the strength and permanence which this implies. *(Please turn to page 94)*

Luminescent and fluorescent plastics

by CHARLES LICHTENBERG*

IN the blacked-out cities of wartime Europe, where the danger from automobiles with darkened headlights almost equals that from falling bombs, pedestrians on the street at night are wearing all sorts of luminous warning devices. These small devices, worn on the cuff, hat or arm, help to cut the number of casualties that result from total darkness.

The property of luminescence that makes these devices effective has long been known but, until recently, was put to little practical use. A luminescent material seemingly absorbs light and stores it. After it has been once exposed to a light source, it glows of itself for hours without further stimulation. This light, produced without fuel or heat, is generally bluish in hue.

The demand caused by conditions of war has caused a rapid development of such materials in Europe, but the expanding uses of the principle have not been confined to the belligerent nations. A great deal has been done in this country, particularly in plastics, to make luminescence and related phenomena commercially valuable in many fields.

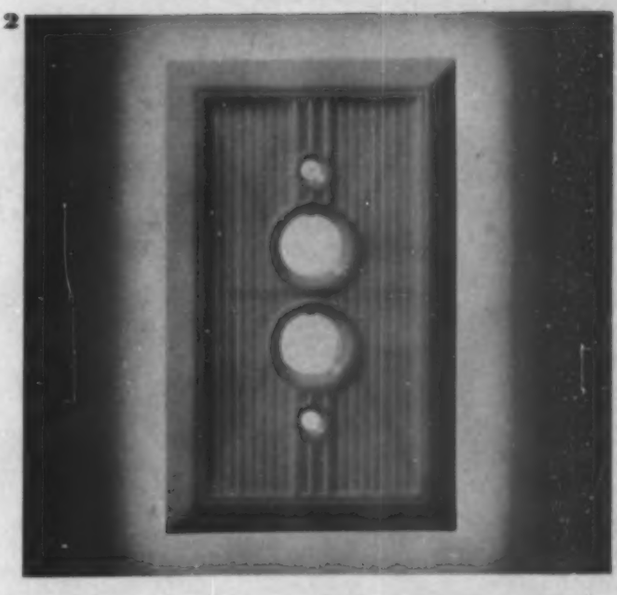
Related to the property of luminescence is fluorescence. Fluorescent materials, too, glow with their own cold light when properly stimulated, but the glow continues only so long as the outside stimulation is acting on them. Fluorescent materials give their effects by transforming light from one wavelength to another, and can be activated by light that is normally invisible. This characteristic is found in nature in some stones, but many fluorescent chemical compounds are known.

Impetus to the improvement of fluorescent materials has been given by two developments where the principle of fluorescence is of vital importance. To many people the greenish glow of a television viewing screen is familiar. The screen, which covers the large end of a cathode tube, acts as the target for rays which are directed upon it from the other end. These rays, which carry the image sent over the air, are invisible, but when they strike the screen which is (*Please turn to page 92*)

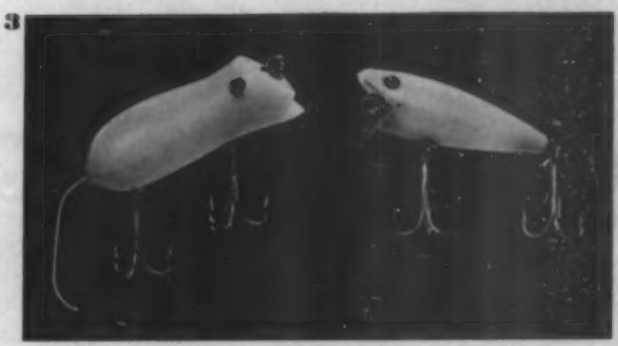
* Monsanto Chemical Co.

1

2



3



1—Dainty, glowing gardenia with petals molded of luminous acetate adds an air of mystery and charm. 2—Fumbling in a dark room for the lightswitch is out-dated with the appearance of these standard size Glo-Plates. 3—In blackest night even the biggest ones won't get away from the tantalizing glow of these Shakespeare Luminous Lures. All luminous plastic can be recharged by exposing it to light for a few minutes or more

Plaskon puts

Typical among the names of hundreds of national advertisers using GILLCO SIGNS are Trommer's Beer, Lullabye Furniture, Atlas Tires, Western Union, and Vitality Shoes. Two of these applications are shown above. The various Plaskon Molded Color units shown are 12¾", 7½", and 6¼" in length, by 2¾" in depth. Colorful Plaskon is molded for GILLCO SIGNS, Inc., Philadelphia, Pa., by Kuhn & Jacob Moulding and Tool Co., Trenton, New Jersey.

more pep and sales personality into signs!

● Point-of-contact selling tools are recognized as one of the most effective profit making items in any merchandising program.

In this field, GILLCO SIGNS have been nationally recognized for over seven years for their spectacular advertising qualities.

Now GILLCO combines glass with Plaskon Molded Color to produce the most distinctive group of signs in America. Striking in eye appeal, free from glare, magnetic in attraction, these signs represent an outstanding development in point-of-sale advertising.

An unusual feature of GILLCO SIGNS is the standardization of shapes and dimensions, which permits Gillco to make several combinations with only three moldings.

Plaskon Molded Color offers manufacturers a great number of advantages in manufacturing and merchandising. It is available in a wide range of warm, glowing tones, that enhance product design and attract buying attention. It is light in weight, yet remarkably strong when properly molded for heavy-duty applications. Plaskon tone values are unchanging, for it is solid permanent color, through and through. Plaskon will not chip, corrode, rust or tarnish. Its smooth, hard, non-porous surface cannot be stained or scratched.

Plaskon Molded Color is the world's largest-selling urea-formaldehyde plastic. We shall be glad to give you the benefit of our technical experience in adapting Plaskon Molded Color to your production and sales-promotion needs. Write for a Plaskon representative to call upon you.

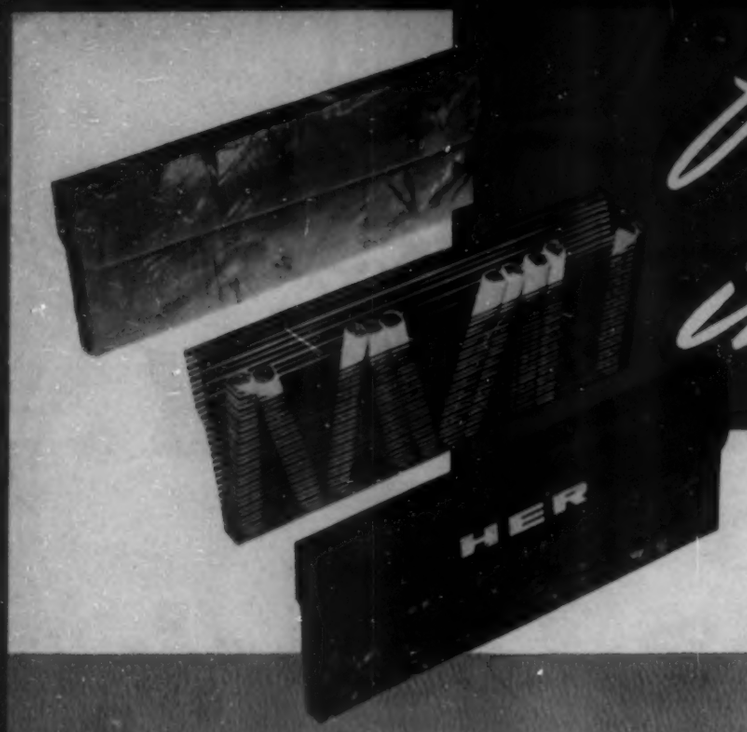
PLASKON COMPANY
Incorporated
2121 SYLVAN AVENUE • TOLEDO, OHIO
Canadian Agent: Canadian Industries, Ltd., Montreal, P.Q.

Trade Mark Registered

PLASKON

★ MOLDED COLOR ★

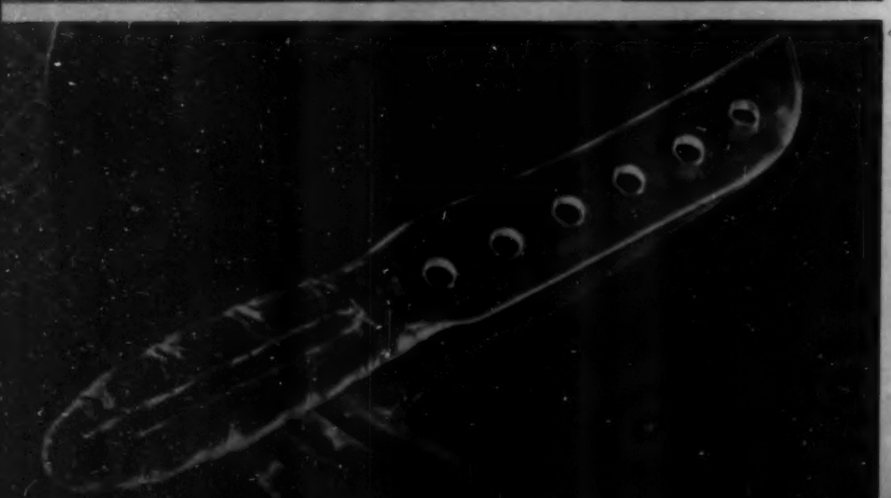
Plastics in Review



1 If you've ever tried to find a cigaret case that will hold a full pack of cigarets and still not be heavy or cumberson, you will breathe a sigh of relief when you see this 1-oz. case made of Lumarith or Plastacele. Smokes—regular or king size—fit in 3 compartments that keep them firm. The resilient flap provides a handy self-closing feature and a 3-letter monogram offers a personal touch. Colors are tawny shell, satiny pearl, tortoise, ruby and opaque flame red, or trim, modern stripes. It's a product of Dura-Plastics, Incorporated

2 Electric shavers housed in a material other than plastics are practically a novelty. The latest development in the Knapp-Monarch line is this Speedster model in a sleek maroon Durez case. The unusual design was dictated by the natural angle shaving head—a feature of this entire line. The housing is rendered heat-insulating, non-reverberating and, in fact, sound-deadening because of the use of a plastics. It is strong and water-proof. Molded by National Lock Company

3 A New Year rolls around, and last year's calendar is really out of date. Designed by Gordon Lippincott for use by executives and employees of large firms, this new memo pad combination comes in company colors, with symbols or trade marks engraved in a rectangular



space at the top. The emblem is wiped in with a contrasting color. In order to remove the pad, you merely press the lever in the front of the stand. Molded of Plaskon and black and mottled Durez by Bridgeport Moulded Products, Inc., for Keith Clark, Incorporated

4 Transparent cake, fruit and vegetable knife is decorative as well as useful. Of Crystalite and Lucite it resists fruit acids and oils. Unlike the glass knives of this type which have been on the market, this plastic model will not chip or break easily, and the possibility of having particles of the material scattered in food is practically eliminated. The knife will leave no taste, nor will it discolor. Molded by Plastics, Inc., for Plastic Creations

5 Now you can use pastel crayons and not be bothered by chalky smudges on your fingers. These chalk crayons are sheathed in a glistening tube of transparent Vuepak, so that you work with pastels all day and never touch the chalk at all, except to peel back the covering. John Oxley makes them for American Crayon Company

6 Telex high fidelity vacuum tube hearing aid complete with receiver, battery connector and display case weighs less than $2^1/_2$ oz. and is only $2^3/_4$ in. in diameter. Three molded Beetle parts are used in the microphone-amplifier unit: the 2 halves of the housing and the volume adjustment control. Plugs and receiver housing are also molded of urea by Telex Products Co. The lightweight and durability of the plastic make it a "natural" for this application

7 For the student's budget, an inexpensive lamp offers glareless Polaroid light that insures good eye hygiene. As the modern successor to the old-fashioned type of "gooseneck" lamp, this model has a vented shade cap of heat-resisting Bakelite, as well as a base and column of the same material. The walnut-finished plastic is combined with shining copper trim and an eggshell-brown parchment type shade. Molders, Associated Attleboro Mfrs., Inc. Designed by Walter Dorwin Teague. The shape of the shade enables the lamp to be used on a table shoved close against a wall

8 Here's a flashlight with a head that can be turned to throw the beam at any angle through a 180 deg. swing. Known as the Swivel-Head model, the lamp, reflector and plastic lens are assembled at the free-moving end. The assembly includes a metal pocket clip, bottom-ring hanger and a 3-point safety-lock switch. The unit will accommodate 2 standard flashlight batteries. Tenite housing molded by General Electric Co. for U. S. Electric Mfg. Corporation

9 It's "hats on" for the firemen with these new helmet models that will make life safer for the fire fighters. Introduced by the Mine Safety Appliances Co., the protective helmet is lightweight, but tough and durable. Like the miners' hats, this model is being molded in one piece of canvas-base Bakelite laminated and screen wire

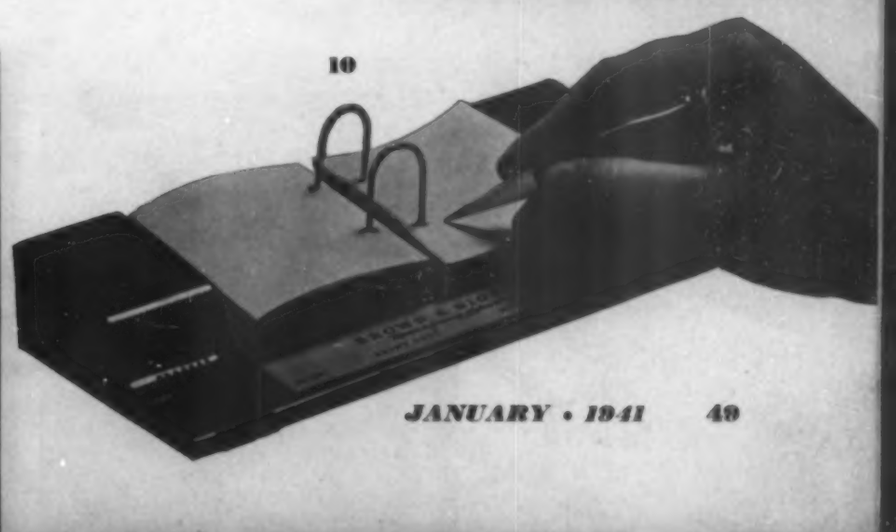
10 The Jot-It Calendar combining a memorandum pad, pin and clip tray is injection molded of Lumarith. Attractive appearance, utility and durability as well as low production cost had to be considered in selecting the material for construction of this unit. Brown and Bigelow who designed and molded the item claim that it not only fills the requirements, but a marked increase in sales is evident. There is space for a metal plate carrying an advertising message. Spun-over plastic studs were used to attach the bottom plate to eliminate fastening devices

7

8

9

6


10

11

11 Devoid of superfluous ornamentation, this handsome radio is housed in a case of Bakelite ivory urea. Also molded in phenolic material for darker colors by Molded Products Co., the set features the selector button device to help you get your favorite stations in a hurry. The model is a product of Radio Products Co. The straight, simple lines follow a current trend in radio designing

12

12 They're Eversharp, the pen and pencil designed by Henry Dreyfuss and made of Pyralin in a wide variety of colors with combinations from stainless steel to solid gold. An interesting effect is obtained by the use of a two-tone striped cap with harmonizing barrel. An over-the-top clip guarantees a snug fit in your pocket. They are, of course, designed to be comfortable as well as efficient in use

13 Hold on to your possession with Grippit, the gadget that will hold your hat, your gloves, your hose—or practically anything else—and not let go until you give the word. It can be screwed to any vertical surface, and the tighter the screw, the tighter the grip. Available in polished black or mottled colors, they are molded of Lumarith by Universal Plastics Corp. for Fragene Products Sales Co. Handy to have in any household these little devices are durable, and will retain their lustrous appearance

13

14 Washable plastic playing cards claimed to outlast 50 decks of ordinary cards are packaged in a box that is reminiscent of oriental antiquity. Molded of Tenite with a raised, overall dragon design on top, the box has a flush, fool-proof hinge and a patented hinge lift thus eliminating the necessity of tipping the box upside down in order to remove the cards. Cards are made of Celluloid and the box, molded by Cruver Mfg. Co. can later be used as a handsome cigaret box

15 This Memokit makes a popular premium as well as a gift. Introduced by the Bates Mfg. Co., it contains 4 concealed compartments, reached by lifting the tab at the right, for those necessary but elusive items—stamps, clips, tacks or rubber bands. The item is molded of mahogany colored Bakelite phenolic plastic by Mack Molding Co. It will withstand hard wear

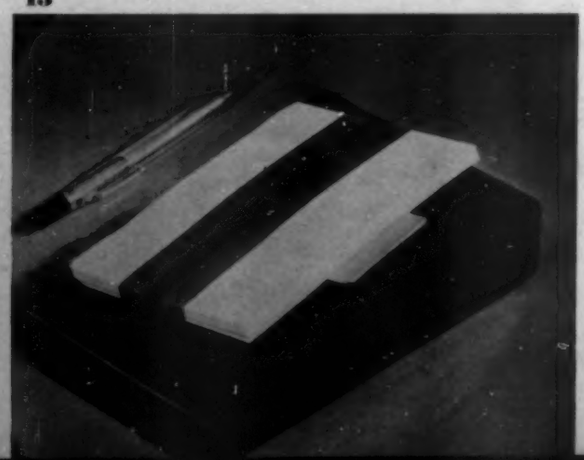
16 Definitely in tune with the times—and are they colorful! These Tri-Tone Catalin handles are red, white and blue, not only patriotic, but serviceable and pleasant to the touch. There is no surface color or finish to wear off, no chipping or scratching to worry about and the cutlery can, of course, be washed repeatedly without damage to the gay handles. They are offered by Englishtown Cutlery, Ltd., and are ideal for merry parties or just everyday use

17 Something new in calendars? Well, here it is. A 12-months-at-a-glance model, unique with a molded Crystalite magnifying lens which clearly outlines and enlarges the current month. The lens is rectangular in shape measuring $1^{3}/_{16}$ in. by $1^{1}/_{2}$ in., having a convex exterior and concave interior surface. The short focal length of the lens required grinding mold cavities accurately to provide for spherical aberration correction incorporated in the mold. Practically unbreakable, the lens competes with ground glass of the fine polished variety. Injection molded by Tech-Art Plastics Co. for Joseph S. Fisher. The months are etched on a brass plate. It is held in place by a small brass frame

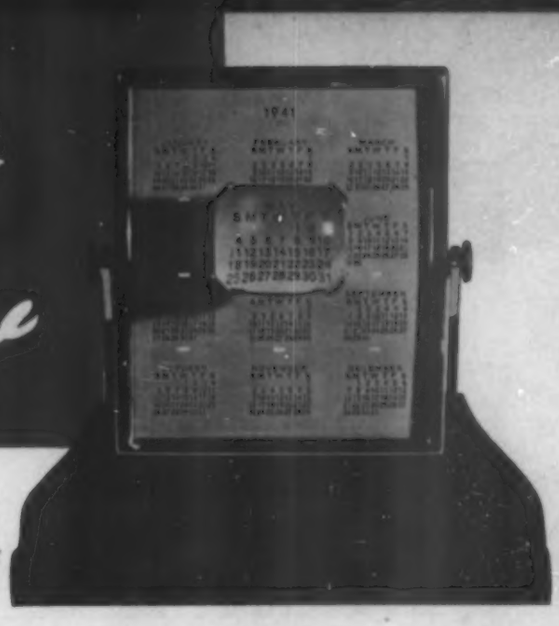
18 When the kiddies play house let them use this midget tableware molded of Monsanto polystyrene plastic. In bright, sparkling colors, the sets are replicas of full-sized silver service in every detail, and all but the knife can

14

15



Plastics in Review



17

be used in eating honest-to-goodness food. There are no sharp edges and the tableware will not become rusty or bent. Frequent washing will not harm, and the material is unaffected by food acids or stains. Molded by Columbia Protektosite Co., Incorporated

19 Display cases made of Lucite are leading a double life in Wallach's remodeled store where each case forms the arm of a sectional sofa. The transparent plastic is made up into box-shaped units, each of which contains one man's shoe. The idea strikes a new note in merchandizing. Cases are practically unbreakable and within easy reach for frequent change of displays. Fabricating was done by Joseph Meyer Brothers

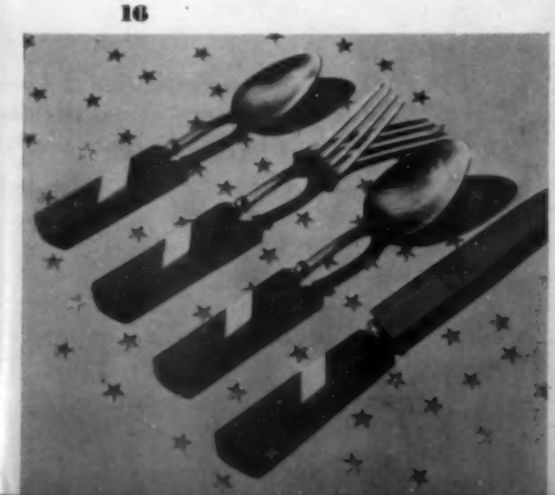
20 A handy, little stapler has a Durez knob and base that withstand wear and always retain their new looking appearance. The base has a solid metal strip insert to give added weight to the unit and absorb some of the excess impact which might be given it at times. The metal parts have a crackle finish which contrasts well with the smooth, lustrous gloss of the molded plastic parts. Molded by Northern Industrial Chemical Co. for Bostitch, Incorporated

For manufacturers' addresses write to the editor enclosing a self-addressed stamped envelope for reply

18

19

16



20

Stock Molds

SHEET ONE HUNDRED-THREE

Suitable for a variety of practical purposes, control balls in standard colors, knobs and handles are available without mold cost from stock molds. Names of molders will be supplied on request

---

1219. Control knob or valve stem, 1 1/2 in. diameter top; 9/16 in. diameter shank; 1 in. high. Metal screw 2 1/8 in. long

1220. Control ball 1 in. in diameter. Threaded brass insert drilled or tapped as required. Solid colors

1221. Control ball, same as 1220 but 1 1/4 in. in diameter

1222. Control ball, same as 1220 but 1 5/8 in. in diameter

1223. Control ball, same as 1220 but 1 3/4 in. in diameter

1224. Control ball, same as 1220 but 2 in. in diameter

1225. Control ball, same as 1220 but 1 1/4 in. in diameter and with molded bead around center

1226. Control ball, same as 1225 but 1 5/8 in. in diameter

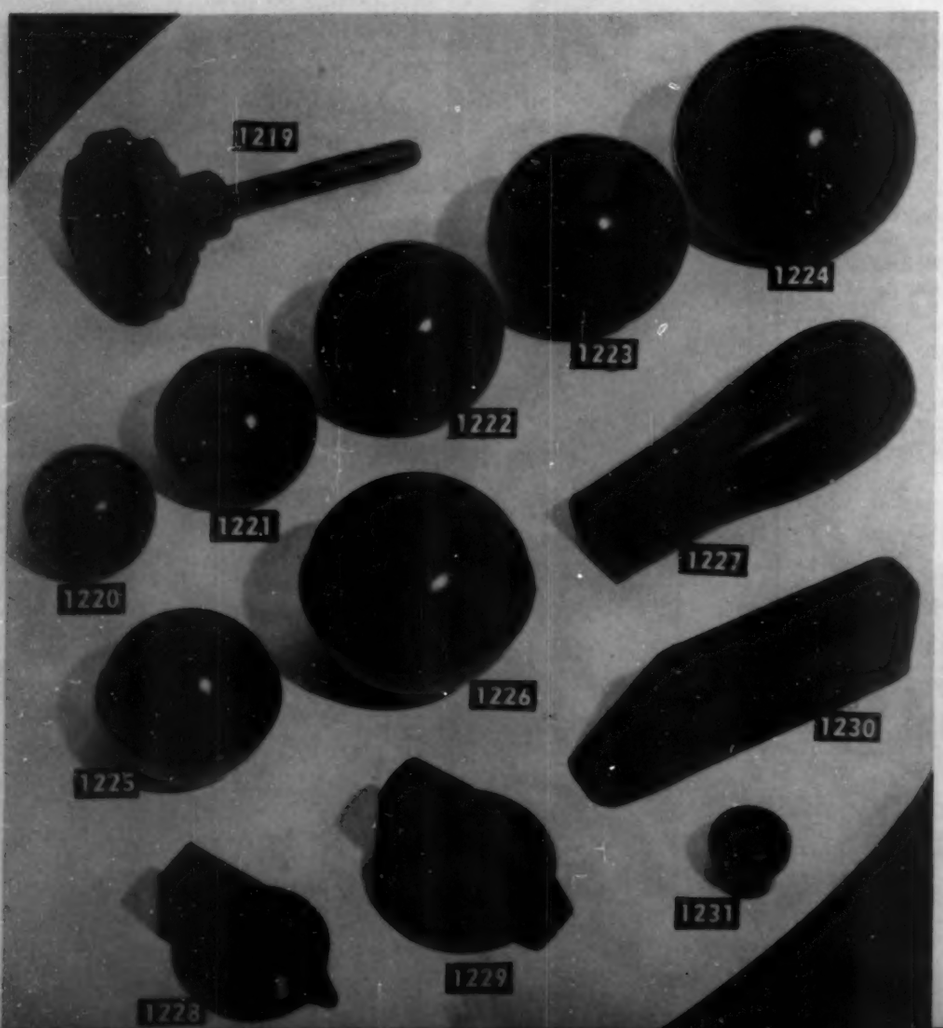
1227. Lever handle 1 1/16 in. diameter, 3/4 in. diameter bottom. 2 7/8 in. long. 1/2 in. hole through center. 5/8 in. counterbore 1/2 in. deep

1228. Small bar knob 5/8 in. high. Round base 1 in. in diameter with 1/4 in. opening. Tapering bar pointer 3/8 in. wide by 3/4 in. long

1229. Medium selector knob 3/4 in. high. Round base 1 1/4 in. in diameter. 1/2 in. bar pointer

1230. Large selector knob 7/8 in. high. Base 2 3/4 in. by 5/8 in. wide. Top 2 in. long. 5/16 in. opening with 1/8 in. counterbore

1231. Binding post nut 1/2 in. high. Diameter top 9/16 in. Shank 7/16 in. in diameter. 1/8 in. threaded brass insert



Address all inquiries to Stock Mold Dept., Modern Plastics, Chanin Building, New York, giving item and sheet numbers

All molders are invited to send samples from stock molds to appear on this page as space permits

Advances in plastics during 1940

General*

A TREND of vast purport has been toward the utilization of plastics by the armed forces of every major nation.[1,2] Military applications, definite and potential, include laminated materials in airplane construction, cast resins in guide lines on airplane carriers, luminescent resins in various military devices, tinted cellulose acetate windows for air raid protection, gun stocks of cellulose acetate and fabric-filled phenolic resins, cellulose acetate chutes for conveying ammunition belts from boxes to machine guns in airplanes, phenolic mouthpieces and containers for gas masks, impregnation of the fabric of gas masks with vinyl chloride resin as a protection against mustard gas, cellulose acetate in soldier's goggles, phenolic noses of anti-aircraft shells, and the possible application of Nylon as a parachute material. In three British fighting services the uses of synthetic resins are said to exceed 1000 in number. A survey of plastics in the United States defense economy indicated that all types were amply available and that the molding and laminating plants were capable of handling extensive increases in production demands.[3]

Another item of general interest is the recommendation in British regulations for the electrical equipment of buildings that electrical apparatus of the all-insulated type be installed wherever practicable and that the use of electrical apparatus (particularly electric toasters and hairdryers) having exposed metal parts be avoided as far as possible. Lamp-holders so constructed of, or so shrouded in, insulating material that it is impossible to touch any metal part were also recommended. The availability of plastics for the construction of all-insulated equipment, particularly molded housings, is said to have prompted this action.[4]

Materials

No really new plastics appeared on the market during 1940, but outstanding progress in developing increased volume and new markets can be credited especially to the vinyl ester resins and cellulose acetate butyrate. These materials took many of the awards in the Fifth Annual Modern Plastics Competition.[5] Vinylidene chloride resin is commanding attention in its applications as high-strength fibers and seat coverings.[6] Nylon resin is entering the industrial field as bristles for brushes used in the textile printing trade.[7] Other highlights of the year in materials development include the production of plastics from cellulose acetate of higher acetyl content (58 percent acetic acid) than previously employed,[8] and the further activity in the manufacturing of melamine resin.[9] Investigations pertaining to the use of farm waste products for the production of plastics were reported on by the Agricultural By-Products Laboratory, Ames, Iowa,[10] and by the University of Tennessee Research Corporation.[11]

Molding and fabricating

Improvements in injection and compression molding presses have been concerned primarily with various operating features, particularly heating[12] and automatic controls.[13] The technic of continuously extruding thermoplastic materials has also advanced considerably during the past year[14] and extruded plastics are replacing reed and rattan in woven furniture.[15] A process for forming molds by spraying metal against a model has been perfected to the point where production molds have been made and are being tested in service.[16]

Applications

The aircraft industry has, of course, been spotlighted during the past year and further important strides were made in the use of plastic plywood for molding airplane wings and fuselages.[17] An outstanding development in this field was the laminated plastic tab for insertion in aileron, elevators and rudders to aid in balancing and controlling the airplane during flight.[18] The reinforced plastic contributes a saving in weight and greater rigidity in this part. Many new applications of black

* Prepared by G. M. Kline for inclusion in the annual report of the Sub-Division on Rubber and Plastics of the American Society of Mechanical Engineers, Dec. 5, 1940, New York.

1. Ind. Eng. Chem., News Edition *18*, 1–13 (Jan. 10, 1940).
2. Modern Plastics *17*, 25–7, 72 (Dec. 1939).
3. Modern Plastics *17*, 25–8, 96, 98 (Aug. 1940).
4. Electrical Review *127*, 107–8 (Aug. 9, 1940).
5. Modern Plastics *18*, 41–111 (Oct. 1940).
6. Modern Plastics *18*, 36–39 (Nov. 1940).
7. Modern Plastics *18*, 67, 96 (Oct. 1940).
8. Modern Plastics *17*, 62–3 (Apr. 1940).
9. Business Week *1940*, 57–9 (Sept. 14).
10. Modern Plastics *17*, 59–61, 88, 90, 92, 94 (June 1940).
11. Business Week *1940*, 51 (Oct. 19).
12. Modern Plastics *17*, 49, 72 (Feb. 1940).
13. Modern Plastics *18*, 65–67 (Nov. 1940).
14. Modern Plastics *17*, 54–5, 88, 90 (July 1940).
15. Modern Plastics *17*, 31–7 (Apr. 1940).
16. Modern Plastics *17*, 36–7, 94 (June 1940).
17. Modern Plastics *17*, 25–31, 78, 80, 82 (July 1940).
18. Modern Plastics *18*, 84, 100 (Oct. 1940).

cellulose acetate plastic in unstressed and slightly stressed parts on aircraft were reported in England.[19]

Resin-bonded plywood is expanding into many industrial fields. Refrigerator cars constructed largely of this material are said to be 6000 pounds lighter than the previously used type and to provide a considerable economy in fabrication costs because of an 86.5 percent reduction in the number of joints and a 19 percent reduction in fastening elements.[20] Simplification of small-boat construction and improved weather-resistance of decking and planking for larger craft have also marked the introduction of this material into the shipbuilding industry.[21]

The use of laminated plastic for bearings[22] and cams[23] in high-speed industrial machinery was further extended during the past year. Jigs and fixtures for light milling operations made of laminated plastic represent a new development.[24] Laminated sheets, rods, bars, and tubes of various cross sections and lengths are available so that these tools can be produced with a minimum of machining operations.

Many branches of industry which had previously made extensive use of plastics added new molded parts to their products. Summaries of developments in the automotive,[25] radio,[26] refrigerator,[27] and mechanical handling fields[28] were published. Other industrial items which merit particular mention are a bilge pump with corrosion-resistant phenolic housing,[29] a motor analyzer consisting of 18 precision-molded parts,[30] and a 5-pole, panel-type magnetic switch with molded phenolic shaft and cold-molded plastic arc chute.[31]

Testing and properties

The two papers relating to time and temperature effects on the tensile and compressive strengths of thermoplastics[32] and on the creep and cold-flow characteristics of thermosetting and thermoplastic materials,[33] were quite outstanding among the contributions to our knowledge of the mechanical properties of plastics published during the past 12 months. The important physical properties and performances of plastic bearing materials were surveyed in another paper originally presented before one of the Divisions of the American Society of Mechanical Engineers at the 1939 Annual Meeting and published during 1940.[34]

The effects of prolonged exposure at elevated temperatures on the tensile strength, hardness, water absorption, weight, and dimensions of phenolic laminates were investigated and recommendations submitted for the maximum temperatures to which these materials should be subjected in continuous duty.[35]

In an investigation[36] of resin-impregnated compressed plywood prepared at pressures up to 1500 lb. per sq. in. compressive strength was found to increase in direct proportion to specific gravity and the tensile strength varied approximately in proportion to the $1^1/_4$ power of the specific gravity. Thin veneers of $^1/_{48}$-in. thickness gave stronger bonds than veneers of $^1/_8$-in. thickness. Other variables such as species of wood, amount of resin, number of cross layers, and pressures from 200 to 1500 lb. per sq. in. were investigated.

Tentative standard methods were adopted by the American Society for Testing Materials for measuring flammability of plastics, flow temperatures of thermoplastic molding materials, and absorption of water by plastics.[37] Three papers pertaining to plastics were presented at the June 1940 meeting of the Society. One of these described an accelerated weathering test for plastics which gives results correlating well with those observed in outdoor exposures.[38] The second paper was concerned with the amount of moisture absorbed and desorbed by plastics for periods up to two years and the effect of various test conditions on the value observed for water absorption in short-time tests.[39] The third paper related to the measurement of the plasticity of molding compounds by means of a $2^1/_2$-in. disk mold with capillaries extending downward from the disk.[40] Another paper resulting from the activities of this A.S.T.M. Committee reported experiments made in measuring the flow temperatures of thermoplastics with the Rossi-Peakes flow tester and three plastometers.[41] This work culminated in the

Equipment used at the National Bureau of Standards for some accelerated weathering tests of transparent plastics

19. Plastics *4*, 32–4 (Feb. 1940).
20. Railway Age *109*, 275–8 (Aug. 24, 1940).
21. Modern Plastics *17*, 27–9, 74, 76 (May 1940).
22. Modern Plastics *17*, 36–7, 90 (July 1940).
23. Modern Plastics *17*, 30–1, 76, 78, 80 (Dec. 1939).
24. British Plastics *11*, 487–90 (Apr. 1940).
25. Modern Plastics *18*, 29–35, 84, 86, 88, 90, 92 (Nov. 1940).
26. Modern Plastics *18*, 31–7, 86, 88 (Sept. 1940).
27. Modern Plastics *18*, 44–5, 94, 96 (Sept. 1940).
28. Mech. Handling *27*, 155–7 (July 1940).
29. Modern Plastics *17*, 39, 92 (July 1940).
30. Modern Plastics *17*, 43 (July 1940).
31. Modern Plastics *18*, 67, 95–6 (Oct. 1940).
32. Mech. Eng. *61*, 892–4 (Dec. 1939); Modern Plastics *17*, 47–9, 78, 80 (Mar. 1940).
33. Trans. A.S.M.E. *62*, 513–24 (Aug. 1940); Modern Plastics *17*, 49–52, 78, 80, 82 (May 1940), 65–8, 84, 86 (June 1940).
34. Trans. A.S.M.E. *62*, 461–67 (July 1940); Modern Plastics *17*, 54–7, 70, 72 (May 1940).
35. Modern Plastics *18*, 59–62 (Sept. 1940).
36. Mech. Eng. *62*, 189–95 (Mar. 1940).
37. Report of Committee D-20 on Plastics, A.S.T.M. 1940 Preprint No. 92.
38. Modern Plastics *17*, 49–57, 86, 88 (Aug. 1940).
39. Modern Plastics *18*, 119–23, 152, 154 (Oct. 1940).
40. A.S.T.M. 1940 Preprint No. 108.
41. A.S.T.M. Bulletin *1940*, 23–6 (Aug.); Modern Plastics *18*, (Dec. 1940).

previously mentioned tentative standard method developed for measuring flow temperatures of thermoplastic molding materials.

A paper published early in the year presented the results of a study of the bursting strength of laminated glasses made with cellulose acetate and acrylic and vinyl resins.[42] This property is of importance in connection with pressure cabins in aircraft for substratosphere flying. All types of laminated glass were found to have higher burst pressures at temperatures near −30 deg. C. than at about 20 deg. C. Some specimens under constant pressure fractured after a few minutes at a pressure one-third of that necessary in burst tests conducted under regularly increasing pressures. The former test is considered more significant in so far as actual use in aircraft is concerned.

42. A.S.T.M. Bulletin *1940*, 21–25 (Mar.).

Surface coatings

by JOHN McE. SANDERSON*

FOR the paint industry the theme song of 1940 has certainly been "Speed and Yet More Speed." As the pace of general industry has quickened the manufacturers of an ever-increasing variety of items have turned to production line methods for economy and increased output. As they have done so, they have found a bottleneck in the finishing room, using methods and materials which were previously acceptable. This challenge has been met by close collaboration between manufacturers of finishing equipment and of paint products, the latter actively backed up by material suppliers, especially those making synthetic resins.

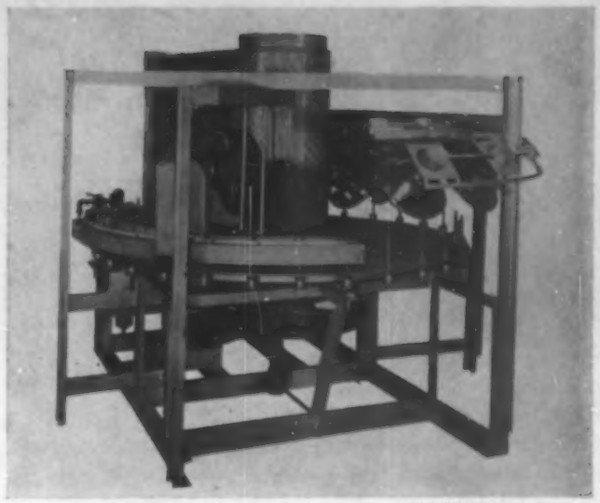
In considering the influence which synthetic resins have had on the development of finishes adaptable to production line speeds, we may group them into three main classes—varnish, lacquer and synthetic finishes.

Varnishes

For this type of finish, synthetic resins are cooked with drying oils, the resultant product then being used as a clear finish or as a pigmented enamel or undercoat. This group would also include paint vehicles in which the proportion of resin is generally very small in relation to the drying oil.

While available in ever-increasing variety to meet individual requirements, the types of resins used in varnishes were fundamentally the same as in previous years. They included ester gum, alkyds, modified and unmodified phenolics, cumarone and a few other miscellaneous resins. For many years past quick drying varnishes have been based on China wood oil, usually in conjunction with phenolic resins. Due to the high price and scarcity of China wood oil, it was extensively replaced during 1940 by other drying oils, notably dehydrated castor, with increasing emphasis on the use of maleic alkyd resins rather than phenolic types. While such varnishes do not ordinarily air-dry with quite the speed of the wood oil types, they may be baked at higher temperatures (and consequently more rapidly) because of greatly superior retention of gloss and color.

* AMERICAN CYANAMID & CHEMICAL CORP.



COURTESY, DE VILBISS CO.

Infrared lamp used to dry synthetic finishes applied by automatic spray to small metal parts

Lacquers

The vehicles in this group of finishes are mixtures of resin with plasticizers and cellulose nitrate or other cellulose derivatives, and the film dries mainly by the evaporation of the solvent. The past year has seen a continuation of the trend toward the use of relatively large proportions of oil-modified alkyd resins in lacquers for outdoor use to obtain maximum gloss and color retention on exposure. During the same period the use of the hard maleic alkyds in indoor lacquers has increased, especially for the finishing of radio cabinets and furniture because of the gloss, fullness, quick solvent release and easy rubbing properties which these resins impart.

Synthetic finishes

(*a*) *Alkyd resins.*—While the term "synthetic" has been much abused, it is generally applied to finishes in which the vehicle is predominantly a solution of synthetic resin used as such, without cooking with oil or combining with cellulose derivatives. Prominent among the resins in this group are the oxidizing type alkyd resins, the use of which reached truly astonishing proportions in 1940. New resins were added to this group as it was found feasible to improve specific characteristics, such as drying speed, color retention and solubility of the finishes.

(*b*) *Urea resins.*—Another group of resins which showed phenomenal growth during the past year includes those made from urea. These thermosetting types have found their major application in baking enamels, generally in conjunction with alkyd resins. Such combinations bake quickly with mar-resistant hardness and excellent color retention and have, there-

COURTESY, AMERICAN CYANAMID & CHEMICAL CORP.

Malec resins impart easy sanding qualities to clear wood lacquers and sealers

fore, found use in a wide variety of metal enamels. Special urea-alkyd resin combinations were also developed during 1940 which for certain applications, such as clear wood finishes, could be baked at temperatures much lower than required by previously available thermosetting resins. As the answer to production line requirements, they will certainly find increased use in the near future. Plasticized urea resins in emulsion form also found use in considerable volume during 1940 as clear finishes on paper and textiles.

(c) *Melamine resins.*—Undoubtedly the most outstanding development for the paint industry in 1940 was the commercial production of organic soluble resins made from melamine. Like those made from urea, they are thermosetting types which find their major application in baking enamels in conjunction with alkyd resins. When such combinations are baked at the temperature range normally used for urea types, they bake more quickly and to a degree of hardness which is quite extraordinary, closely approaching molded plastics in this respect. Melamine resins have also been found more generally suitable than the urea types for relatively low baking schedules and they retain gloss and color to a much greater degree on prolonged subjection to high heats. They also exhibit superior resistance to weather exposure and to grease and chemicals. With this combination of characteristics melamine resins are going into enamels for use on everything from stoves to refrigerators, from autos to cake boxes.

Baking equipment

In the ordinary baking oven, heat transfer is accomplished by convection air currents. Improved ventilating devices have assured not only more uniform heating throughout the oven but better heat transfer by eliminating the blanketing of the work by a layer of solvent vapor and dead air. During the past year there has developed a more widespread use of other methods of heating such as electrical induction and, more particularly, the use of infrared lamps.

The pioneer work by the Ford Motor Company on baking of undercoats on automobile bodies with infrared lamps has been watched with ever-growing interest by other users of industrial finishes. There now seems to be a better realization of the efficiency of this means of focusing heat on a finished surface. It frequently means the ability to bake at a substantially higher temperature than is feasible when the whole mass of the finished article has to be heated up in the oven. Furthermore, the newer resins, particularly the urea and melamine types, have been found especially suitable for these quick high-temperature bakes and have contributed largely to development of this technique.

Future developments

A review of the recent past readily justifies the keen anticipation with which the paint industry is facing the future. The manufacture of surface coatings has definitely passed into the hands of technical experts and rich rewards await those who are alert to take prompt advantage of the continued stream of developments from the many research laboratories in their own and the chemical industry.

Phenol resins

by S. H. HALL*

UNFORTUNATELY for a discussion of this type, the record of progress made during the past year in phenolic resins is confined to the few theoretical investigations which have appeared in print and the patents allowed. Research on the phenol-aldehyde types which was most extensive during the previous years is not revealed strongly in either the reports of theoretical search or patents. However, there is no doubt that there is a tremendous amount of research in this field by manufacturers, and evidence of their progress is constantly revealed by improved physical characteristics in their molding compounds. Obviously, most of the work along this line is not available except in so far as the few patents granted.

Further evidence to substantiate claims that ether bridges are formed as a primary reaction in the resinification of dimethylol phenols is offered in "The Hardening of Phenol Formaldehyde Resins."[1] In "The Chemical Nature of Phenol-Aldehyde Resins"[2] the author covers several aspects of primary reactions, resinification reactions and reactions to the final C stage. A picture of the physical structure of phenol-aldehyde resin by P. M. Kozlov[3] reveals it as a colloidal system with the solid high molecular polymer as the disperse phase and a mutually soluble mixture of phenol alcohol, derivative of dihydroxydiphenylmethane and water, as the plastic solvate phase, the catalyst acting as a stabilizer. It explains hardening and other changes in mechanical properties by his hypothesis. Still another theory from the physical standpoint is found in "Phenol Plastics."[4] The formation of methylene bridges is concluded in "Guiacol Formaldehyde Resin Mechanism."[5] Evidence of similar dielectric behavior in five phenol-formaldehyde condensation products is revealed in a study of "The Electrical Properties of Thermoplastics."[6]

* DUREZ PLASTICS & CHEMICALS, INC.

The trend of industrial research from a survey of the patents allowed is shown definitely to be primarily along modified lines which comprise by far the largest group. Very little appears in the strictly unmodified group. The most interesting developments in this latter group are the cold-setting of a liquid phenol-formaldehyde resin with acid,[7] a water soluble phenol-aldehyde condensation product with an alkaline catalyst which is suitable for blending with latex,[8] and a liquid resin composition which will not harden at room temperature but will harden relatively rapidly at elevated temperatures.[9]

Turning to the modified group, one finds several excellent advances in resins for coatings and impregnating varnishes.[10–14] Apparently researchers are gradually bridging the gap between the brittle phenolic molded pieces and the more elastic rubber pieces, and when the final span has been laid another tremendous upswing in the phenolic plastics field may be expected. A product has been obtained by reacting rubber, maleic anhydride and a phenol at elevated temperature plus a further reacting with an aldehyde, which is suitable for molding compositions.[15] Replacement of hexa with dimethylol urea improves the color of phenol-formaldehyde resins.[16] A glass-clear, transparent condensation product is obtained by reacting phenol with formaldehyde with an alkaline catalyst, lactic acid and a reactive urea-formaldehyde condensation product.[17] Of interest, also, is a liquid resin suitable for casting which cures in two to three days at 70–80 deg. C.[18] A resin suitable for coatings, adhesives, fabric impregnation, brake linings and molding compositions is made from a resin like phenol-aldehyde reacted with an ester from esterifying cashew nut shell liquid.[19] A phenol-formaldehyde resin, formaldehyde-hardened soybean meal and woodflour in the proportions of 3:3:2 is said to produce a molding compound with as fine a finish, cure, strength and permanence as the average phenolic compound.[20] Yet another material for molding, coatings or creaseproof fabrics has been patented—formed by reacting a phenol, an aromatic sulfonamid and a halogenated aliphatic group.[21]

There has been also a great expansion or broadening of research in pursuit of further applications as witnessed by the tremendous increase in the development of phenolic resins for varnishes, enamels, printing inks and other important outlets.[22–46] Conclusive proof of advancement is no doubt revealed in the consistent increase of production by the phenolic resin manufacturers, such production being indisputable evidence of new and greater service being rendered industry in general.

1. Franz Hanus, Erich Fuchs and Erich Ziegler. Journal für praktische Chemie *153*, 327–36.
2. Organic Chemical Industry (USSR) *3*, 385–93.
3. Trudy Sessu Akad. Nauk Org. Khim. (1939) 91–7.
4. H. Stager, R. Sanger and W. Siegfried. Helvetica Physica Acta *12*, 561–80.
5. Hans V. Euler, Erich Adler and Dragmar Friedman. Arkiv för Kemi, Mineralogi och Geologi *13B*, No. 12.
6. L. Hartshorn, N. J. L. Megson and E. Rushton. Journal of the Society of Chemical Industry *59*, 129–33.
7. I. G. Farbenindustrie A.-G. Brit. 507,208.
8. Virgil E. Meharg (to Bakelite Corp.) U. S. 2,190,672.
9. Wesley R. Thompson and Wm. E. Flood (to Catalin Corp. of America) U. S. 2,186,687.
10. Albert Products Ltd. Brit. 511,511.
11. Kurt Albert G. m. b. H. Chemische Fabriken Ger. 684,225.
12. Wm. H. Butler (to Bakelite Corp.) U. S. 2,171,914.
13. Bakelite Ltd. Brit. 507,770.
14. Arthur Haroldson (to Continental Diamond Fibre Co.) U. S. 2,185,080.
15. R. P. R. Association. Cyril A. Redfarn and Philip Schidrowitz. Brit. 507,995.
16. Werner Lück. Kunststoffe 29, 306–7.
17. Ludwig Czerny (to Resinous Products and Chemical Co.) U. S. 2,175,793.
18. Karl Loos. U. S. 2,205,427.
19. Emil E. Novotny (to Durite Plastics, Inc.) U. S. 2,170,950.
20. George H. Brother and Leonard L. McKinney. Industrial and Engineering Chemistry *32*, 1002–6.
21. Wm. H. Moss. Brit. 506,999.
22. Victor H. Turkington and Wm. H. Butler (to Bakelite Corp.) U. S. 2,173,346.
23. Wm. J. Bennister (to Resinox Corp.) U. S. 2,176,951.
24. E. N. Freidberg and S. N. Ushakov. Russ. 52,334.
25. Israel Rosenblum. U. S. 2,175,215.
26. Israel Rosenblum. U. S. 2,189,833.
27. Geo. S. Weith (to Bakelite) U. S. 2,199,900.
28. Ellis Foster Co. Brit. 507,658.
29. Winfrid Hentrichand and Fritz Schlegel (to Henkel and Cie. G. m. b. H. (U. S. 2,175,393).
30. N. Ya. Davydov, R. B. Brakhman and G. M. Sokolov. The Organic Chemical Industry (USSR) *7*, 94–8.
31. N. Sachanen and Pharez G. Waldo (to Socony Vacuum Oil Co.) U. S. 2,196,318.
32. Israel Rosenblum. U. S. 2,169,991.
33. Bakelite Ltd. Brit. 507,013.
34. Ernest P. Irany (to Shawinigan Chemicals Ltd.) Canada 387,669.
35. H. M. Dent and A. F. Shepard (to General Plastics, Inc.) U. S. 2,186,406.
36. Israel Rosenblum. U. S. 2,207,384.
37. Almon G. Hovey and Theodore S. Hodgin (to Reichhold Chemicals, Inc.) U. S. 2,197,724.
38. G. D. Kreitser and O. M. Klimova. Lesokhim. Prom. 1938 No. 3–4, 22–4. Khim. Referat. Zhur. 2, No. 4, 130–1 (1939).
39. S. N. Ushakov, S. I. Matveev and O. B. Iv. Lesokhim. Prom. 1939, No. 1, 23–31; Khim. Referat. Zhur. 1939, No. 8, 111.
40. Hermann Burmeister (to General Electric Co.) U. S. 2,192,030.
41. Alvin F. Shepard, Joseph F. Boiney and Lothar Sontag (to General Plastics, Inc.) U. S. 2,203,206.
42. Howard K. Nason (to Anderson-Stolz Corp.) U. S. 2,182,208.
43. Edwin T. Clocker. U. S. 2,188,890.
44. Anderson W. Ralston. Oil and Soap *16*, 215–18.
45. Leon E. Champer and Leo M. Christensen (to Chemical Foundation, Inc.) U. S. 2,189,132.
46. G. D. Graves (to E. I. du Pont de Nemours and Co.) U. S. 2,190,289.

(please turn to next page)

Reservoirs overhead and resin kettles below are used for blending phenol, formaldehyde and catalyst

COURTESY, BAKELITE CORP.

COURTESY, TAYLOR, FORMICA

Laminated plastic trim tabs for use on ailerons, elevators and rudders of airplanes are light, strong, corrosion-proof and rapidly produced

Laminates

by WILLIAM ROSE*

THE most interesting and novel development of the year is the adaptation of fabric base laminated phenolics in the manufacture of trim and control tabs for airplanes.

These tabs represent the first plastic control surface that has been developed for airplanes. They combine the valuable features of lightness and strength. They are used in place of metal or fabric parts now employed in airplane construction. The laminated phenolic base structure is only one-half the weight of aluminum and on strength tests the plastic tabs have far exceeded the specifications established for metallic tabs. The resiliency of the laminated structure causes the tab to keep its shape under stress where metal parts often are permanently distorted. The smooth, uninterrupted surface of the plastic tab offers many advantages over a metal tab having projecting rivet heads or overlapping seams. Moisture does not affect the material and it is not subject to corrosion. Of particular interest to designers of military airplanes is the fact that holes made in laminated plastic tabs by bullets result in no shattering or tearing of material.

Now that laminated phenolic tabs have been developed and have proved their merit, the next logical step in the development is toward larger control surfaces such as ailerons, elevators and rudders. A considerable amount of development in this field is now under way.

Another interesting development in connection with airplane construction is a radio antenna mast made from linen base phenol fiber rolled in tubular form into an airfoil section. An antenna mast of this material is lighter in weight than the metal masts heretofore used and in addition to being an insulating material, the radio receiving and sending characteristics are substantially improved when this type of mast is employed.

* TAYLOR FIBRE CO.
** MODERN PLASTICS, October 1940, page 100.

Urea-formaldehyde resin

by M. H. BIGELOW*

STATISTICS released by the U. S. Tariff Commission reveal that the production of urea-formaldehyde resin compounds for 1939 was approximately 16,500,000 pounds. It is a safe prediction that the production of urea resin compounds for 1940 will exceed that of last year. Some of this increase can be attributed to the wider use of urea resin compounds in lacquers and adhesives. It is noteworthy that urea-modified automotive finishes are superior to former finishes, particularly with respect to abrasion resistance. It is really phenomenal the way deep scratches heal to an unmarred surface. Certainly the automobile of today requires less attention to maintain its exterior beauty, and this is due primarily to the properties of the urea resins.

Urea resins, made by reacting formaldehyde with urea, are available in three commercial forms. Combined with cellulose as a filler, urea resins are available in granular form as a molding compound. In conjunction with heat and pressure, such a material may be molded into a variety of shapes and forms. Urea resins are available in syrup form, the liquid in most cases being composed of one or more hydrocarbon vehicles such as benzene or toluene. This material is suitable for the manufacture of lacquers. If the vehicle is aqueous, the resultant syrup is used for laminating purposes. Urea resin may be dried into a special form and as such is available for the adhesive field.

Urea resin production this past year has increased because of its rapid acceptance for the manufacture of plywood, particularly for use where immunity to the effects of water are tantamount. (See page 44.)

The urea-formaldehyde resin adhesives are so permanent that they are rapidly coming into general use: a characteristic use is the bonding of fabric to cardboard in the manufacture of automotive interior trim. Because urea-formaldehyde resin adhesives are available for cold pressing, laminated woods in thick sections can now be made economically with the result that such a material is rapidly entering the field where, to date, only solid woods have been used. In support of this, we might point out the use of laminated wood for beer barrel staves, skis, and other similar items.

While urea-formaldehyde molding compounds have increased in use for the general run of items with which they are generally associated, such as bottle closures, clock cases, buttons, handles, etc., there has been a noticeable increase in the use of ureas for other and newer items. A new non-metallic collapsible tube has been announced which is a combination of vinyl or rubber hydrochloride tubing with automatic urea-formaldehyde dispensers. While this item is a new adaptation of plastics, it is conceivable with the present situation with respect to tin that such a tube will become a standard commodity in the very near future.

* PLASKON CO.

In the field of hygiene, molded urea-formaldehyde items are rapidly increasing in number. One company is marketing a complete molded urea manicuring unit consisting of five separate molded parts.[1] This is one of the many items in our present-day use which is justified because of the physical properties of the plastic from which they are molded.

Urea plastics continue to hold their own for the manufacture of radio cabinets, and anyone proposing to design a new radio cabinet in plastics should study the essential points which must be considered in order to produce a satisfactory plastic case.

For the past several years molded urea plastics have been used in the manufacture of semi-indirect lighting bowls for modifying the light output of Mazda incandescent bulbs. An underlying feeling existed that with the advent of the new fluorescent type of lighting there would be a decrease in the consumption of ureas for lighting use. This has not been the case. Indirect bowls have been produced in increasing numbers and designs, and further than this ureas are used in large amounts for the molding of tombstone sockets for the fluorescent tube. Fluorescent tube lighting suffers from the defect common to nearly all light sources, namely, too high brightness. To date the only practical way to solve this is with the use of urea-formaldehyde molded louvers. Fluoroliers, embodying the use of urea resin louvers, are keynoted this year in the lighting field.

Due to its abrasion-resistant qualities, combined with pleasing colors, ureas have entered a new field, namely, the manufacture of casters for furniture.

The year 1940 has found Hodgins and Hovey as active as ever in the urea-formaldehyde resin field, and a report of their activities was made available to the annual convention of the American Chemical Society held in April.

Urea-formaldehyde resins have been the subject of several interesting technical papers, one appearing in *Kunststoffe*, Volume 30, April 1940 issue, covering molded buttons. Particular attention is called to an article by Kline, Martin and Crouse, October 1940 issue of MODERN PLASTICS, entitled "Sorption of Water by Plastics."

To those interested in the manufacture of urea and phenolic laminated materials, attention is called to an article appearing in *Kunststoffe*, Volume 29, October 1939 issue, in which a method is shown for determining the number of layers in laminated plastics using hydrogen peroxide for dissolving the urea resins, and nitric acid in the presence of acetone for dissolving the phenolic, leaving the paper sheet base identifiable.

Finally, it is noteworthy that urea molded plastics have definitely found their place in the production of electrical equipment where excellent electrical characteristics are required. Of all the commercial plastics available, urea resins seem to be best with respect to non-tracking, non-arcing qualities.

[1] MODERN PLASTICS, June 1940, page 33.

[2] MODERN PLASTICS, March 1940 issue, "Small Radio—Today and Yesterday."

References

Urea-Formaldehyde Resins. H. C. Worsdall, Oil Color Trades J. *97*, 848–51.

Molding Carbamide Plastics at High Temperatures. T. A. Khorin, Org. Chem. Ind. (U. S. S. R.) *7*, 32–3 (1940).

Urea Resin Finishes—Their Functions and Characteristics. Can. Chem. Process Ind. *24*, 9–10 (1940).

Chemical Examination of Urea Coating Resins. J. J. Levenson, Jr., Ind. Eng. Chem., Anal. Ed. *12*, 332–7 (1940).

Polished Sheets of Urea-Formaldehyde Resin. Brit. Plastics *11*, 398 (1940).

Adhesives. British Plastics *12*, 33 (1940).

Plastics Continue to Advance. Chem. & Met. Eng. *47*, 78–80 (1940).

Urea-Formaldehyde Film Forming Compositions. Hodgins & Hovey, Ind. Eng. Chem. *32*, 334–45 (1940).

U. S. Patents

2,174,012—S. L. M. Saunders, L. W. Conveney, Urea-Formaldehyde Condensation Products for Lacquers.

2,174,535—L. Smidth, Urea-Formaldehyde Casting Compound.

2,175,475—O. R. Ludwig (to Resinous Products & Chem. Co.), Urea-Formaldehyde Condensation Products—Stable Solutions.

2,178,358—A. M. Howald, L. Meyer (to Plaskon Co.), Urea-Formaldehyde Surface Coatings.

2,183,857—V. H. Turkington (to Bakelite Corp.), Urea-Formaldehyde Molding Material—Gears.

2,185,167—T. S. Hodgins, A. G. Hove (to Rechold Chem.), Urea-Formaldehyde Ethylene Glycol Water Soluble Resins.

2,186,821—D. Cordier (to Plaskon Co.), Urea-Formaldehyde Reaction Products.

2,187,081—T. S. Hodgins, A. G. Hovey (to Reichold Chem.), Urea-Formaldehyde Resins.

2,187,383—O. K. Ludwig (to Röhm and Haas), Urea-Formaldehyde Laminating Material.

2,189,563—H. Dohse, R. Rober, Urea-Formaldehyde Phenylthiourea Condensation Products.

2,189,737—B. N. Lougovoy (to Ellis-Foster), Urea-Aldehyde Condensation Product.

2,190,239—A. Menger (to Plaskon Co.), Adhesive.

2,191,949—R. W. Belfit (to Plaskon Co.), Urea-Formaldehyde Molding Compound.

2,191,960—A. M. Howald (to Plaskon Co.), Urea-Formaldehyde Condensation Product.

2,192,129—C. Ellis (to Ellis-Foster), Urea-Formaldehyde Resin Products.

2,193,630—A. M. Howald (to Plaskon Co.), Urea-Formaldehyde Resin Hardener.

2,193,635—A. E. Marshall (to Plaskon Co.), Urea-Formaldehyde Coated Plaster.

2,193,670—M. H. Bigelow (to Plaskon Co.), Urea-Formaldehyde Molding Compound.

2,197,723—T. S. Hodgins, A. G. Hovey (to Reichold Chem.), Amino Resins.

2,200,691—C. Ellis (to Ellis-Foster Co.), Urea-Formaldehyde Adhesive for Safety Glass.

2,200,931—P. M. Moore, Creaseproofed Textiles.

2,201,021—E. H. Balz (to Plaskon Co.), Urea-Formaldehyde Molding Compound.

2,201,027-8—D. Cordier (to Plaskon Co.), Urea-Formaldehyde Molding Compound.

2,201,891-2—D. E. Edgar, P. Robinson (to E. I. du Pont), Urea-Formaldehyde Resin Coatings.

2,201,926-7—B. E. Sorenson (to E. I. du Pont), Urea-Formaldehyde Resin Solutions.

2,203,772-3—D. Cordier (to Plaskon Co.), Urea-Formaldehyde Molding Compound.

2,203,794—L. Meyer (to Plaskon Co.), Urea-Formaldehyde Molding Compounds.

2,203,800—J. K. Simons (to Plaskon Co.), Urea-Formaldehyde Molding Compounds.

2,209,943—L. Smidth (to Luco Prod.), Urea-Formaldehyde Molding Compound.

Thermoplastics

by JOHN M. DE BELL

THERMOPLASTICS in 1940 conformed to the most approved political trend by expanding and becoming tougher. According to our estimates sixty million pounds of thermoplastics will have been produced in the country by the close of the year, including thirty-eight million of cellulosics, twenty million of unsaturate copolymers (vinyls, acrylates, styrol), and five million polyamids; and excluding cast film. Almost

every branch of the industry has participated in the advance, and in the case of the newer materials, existing plants have been unable to keep up with the demand, so many new construction projects are now under way.

One of the most impressive growths has been in the tough flexible copolymers. Aside from the synthetic rubbers derived from butadiene and isobutylene, which are not considered in this compilation, and building from the introduction of strong, rubbery polyvinyl butyral safety glass sheet and stout polyamid filaments in the preceding years, the various manufacturers of polyvinyl derivatives have come to full realization that if the molecular chain length is long enough (to ensure toughness), the substituent groups are properly chosen (to control softening point, insolubility, and cost), and the orientation is adjusted mechanically (to reduce strain or give strength in a particular direction), almost any properties may be attained for attack on rubber, leather, and fabric.

In the vinyl field, large poundages of calendered sheet are moving into wrist watch straps, suspenders, belts, and gaskets; with good quantities in ladies' ornamental shoes, drapes, plastic binding, and coated cloth.[1,15] These products may be copolymerized vinyl chloride-acetate, plasticized vinyl chloride, or non-chlorine containing vinyl derivatives.[2] Beer can coatings and sound records continue to furnish good backlogs. Abroad, rigid types are used for pipes.[3] During the year, vinylidene chloride has become commercial, and is furnished in extruded shapes as fish line of very high tensile strength—over 40,000 lbs. per sq. in.—and "rattan" for woven chair seats.[4] Along with nylon fiber, it gives good illustration of the stoutness which can be obtained when long chain polymers are strung in bundles in one direction.[5,6]

Rubber hydrochloride has continued to gain in the packaging field because of its physical properties, heat sealability, and good moisture vapor resistance. The vinyl chloride polymers exhibit the same excellence, and it is quite probable that the coming year will see vastly increased use of these materials in the form of thin film or coatings on rigid fiber or paper bats.[7] Numerous efforts are under way to apply these to coffee packing. With the considerable trend to low temperature packed foods, large containers for foods below 50 deg. F. are now offered as a carton containing a rubber bag (from latex) which can be hermetically sealed by merely twisting the neck.[8]

COURTESY, RÖHM AND HAAS

Acrylic sheet is extensively used in modern aircraft for windows and enclosures as the commander's dome and blister on this Boeing Flying Fortress

Molding powders from cellulose acetate, ethyl cellulose, and their homologs have passed cellulose acetate sheet in volume, both on account of their own growth and the replacement of safety glass sheet by vinyl acetals. Automobiles take from one to three pounds each, the automotive production this year having gone largely to acetate-butyrate on account of the improved water resistance.[9] Large molded acetate covers have been successfully combined with equally large metal inserts as another means of achieving form stability and dimension in major shell-shaped pieces.[10] Rigid transparent boxes of .0075 and .010 sheet are used in higher priced packaging, and extruded cellulose acetate-butyrate or ethylcellulose has been marketed for summer furniture.[11] Both, when properly formulated and formed, weather well. From England is recorded the melancholy use of acetate sheet first to hold glass together in windows, and second to replace it after it has been blown out. Spurred by the glass-clear resins, cellulose acetate manufacturers have produced improved clarity considered impossible a few years ago.

Styrol and the methacrylates have been running neck-and-neck in such curiously assorted outlets as national defense, household electrical devices, and ultra-decoration. Military aeroplanes are estimated to average twenty pounds of methacrylate apiece, and the tendency is strongly upward.[12] Injection molded brushes of all descriptions, cast methacrylate fountain pens, highway reflectors, and dentures[13] are distinctly the fashion, while the economical production of low strain rod in small sizes has encouraged the use of this form by designers.[14] Exquisite furniture has been designed, at

Hydrolysis kettle is used in early stages of manufacturing vinyl butyral resin

1. Douglas, J. I. E. C. *32*, 315–19. Merrill, News Ed., A. C. S. *18*, 496–7 (Modern Plastics, April 1940, 64). Price, India Rub. World *3*, 47–9.
2. Vinyl acetals. Ushakov, J. App. Chem. (Russ.) *12*, 862–6: Morrison, U. S. Pat. 2,179,051; Bachmann, U. S. Pat. 2,186,598; Kranzlein, U. S. Pat. 2,187,570; Fordyce, U. S. Pat. 2,188,344; Perkins, U. S. Pat. 2,194,613; Nordlander, U. S. Pat. 2,195,122; Kenyon, Can. Pat. 384,966; McNally, Can. Pat. 386,580.
3. Raalf, Kunststoffe *29*, 275–8.
4. Goggin, Modern Plastics *18*, 36, (Nov. 1940). Pierce, Modern Plastics 49, (Nov. 1940).
5. Recent polyamid patents: Flory, U. S. Pat. 2,172,374; Carothers, U. S. Pats. 2,174,619, 2,190,770, 2,191,556; Coffman, U. S. Pat. 2,193,529.
6. Symposium on Textile Fibers, Am. Chem. Soc. J. I. E. C. *32*, 1543–71. Chem. Industries *46*, 150–5.
7. Miller, Modern Plastics *17*, March 1940, 33: Wagner, U. S. Pat. 2,176,370; Robertson, U. S. Pat. 2,185,356; Hackford, Brit. Pat. 511,843.
8. Container Corp. Modern Packaging, Sept. 1940, p. 87.
9. G. M. Kline, S. A. E. Journal *46*, 198–214 T.
10. United Autographic Register Co., Modern Plastics *17*, (49, Oct. '40).
11. Modern Plastics *17*, 31 (April 1940).

about the prices one would expect.[11] Styrol is doing an outstanding job in small molded refrigerator parts, radio insulation, dashboard moldings and coaxial cable.[16] The depth-brilliance of cellulose acetate laminated to paper has now been extended to transparent moldings, where opaque lettering and designs are applied to the back of the piece under considerable thickness of clear plastic as the Buick horn buttons.

Groundwork is being laid for thin blown ware,[17] which shares with injection molded toys the distinction of furnishing the first competition with conventional blown nitrocellulose sheet in a generation. Small experimental production bottles of vinyl chloride-acetate are being made for pharmaceuticals, and Christmas tree balls of cellulose acetate appeared in 1940.

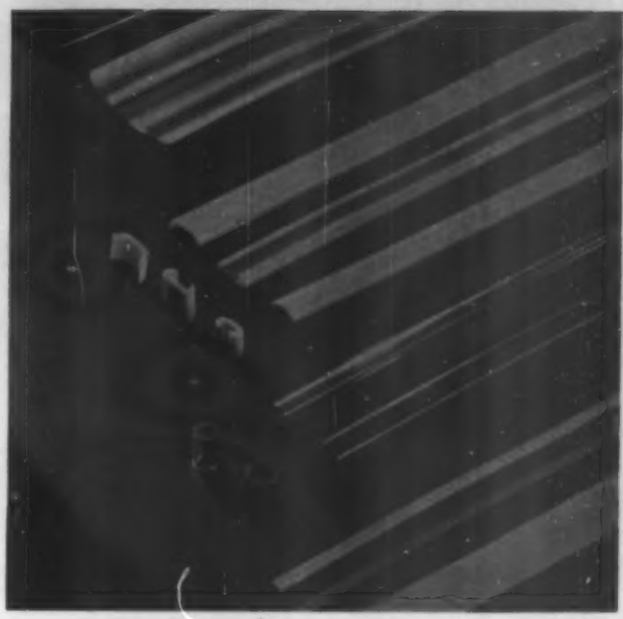
The polyamids progress is best attested by news notes that new plants are under construction to bring capacity to 16,000,000 lbs per year. At the other end of the price scale, an oil-insoluble terpene acid corresponding to oxidized rosin (Vinsol) is being used in large tonnage as a binder for low cost board and related moldings.

Issuing patents offer a melange of different copolymers,[18] plasticizers,[19] and compositions.[20] Excellent literature for the guidance of development workers is appearing[21,22], including first reports of silicon resins for temperature resistance,[23] vapor phase polymerization,[24] and technique of polymerization and property control.

From the national defense standpoint, the outstanding work of the year was, of course, the commercial introduction of butadiene or isobutylene rubbers[25] by all major rubber companies. Broadly speaking, supply of base chemicals for plastics appears adequate, unless equipment for expansion is unduly slow in delivery.

---

12. G. M. Kline, Communication.
13. Sweeney, J. Am. Dental Assoc. *26*, 1863–73 (MODERN PLASTICS, Feb. 1940, 42). Merrick, U. S. Pat. 2,205,488.
14. James Bailey, Communication.
15. Sanders, MODERN PLASTICS *17*, 45 (Oct. 1940).
16. MODERN PLASTICS *17*, 88 (Sept. 1940). Weith, *et al.*, J. I. E. C., *32*, 1301.
17. Ferngren, U. S. Pat. 2,175,053, and Kopitke, U. S. Pat. 2,175,054.
18. New resin literature: Brit. Plastics *11*, 317–21; Rutovskii, Org. Chem. Ind. (Russ.) *7*, 80–4; Rust, J. I. E. C. *32*, 64–7; Frey, U. S. Pats. 2,129,466–7, 2,198,936; Otto, U. S. Pat. 2,172,403; Muller, Conradi, U. S. Pat. 2,180,082–3; Martin, U. S. Pat. 2,181,663; Patnode, U. S. Pat. 2,181,739; Lazier, U. S. Pat. 2,182,991; Britton, U. S. Pats. 2,186,359–60, 2,205,390; Hopff, U. S. Pats. 2,187,817, 2,182,316; Bruson, U. S. Pat. 2,187,565; Stoesser, U. S. Pat. 2,190,-906; Bass, U. S. Pat. 2,190,915; Voss, U. S. Pat. 2,200,437; Fletcher, U. S. Pat. 2,201,395; Garvey, U. S. Pat. 2,202,846; Patrick, U. S. Pat. 2,206,641; German Pats. 679,944, 685,257; British Pat. 509,760; French Pats. 841,537, 844,554.
19. New Plasticizer literature: Kalman, Paint Mfr. *10*, 33; Reinhart and Kline, J. I. E. C. *31*, 1522–9 (Effects of); Coleman, U. S. Pats. 2,170,989–90, 2,205,395; Grether, U. S. Pat. 2,170,995; Robinson, U. S. Pat. 2,173,181; Stoesser, U. S. Pats. 2,174,538, 2,187,695; Alexander, U. S. Pats. 2,175,048–9, 2,179,973, 2,193,613, –4, –662; Ralston, U. S. Pat. 2,178,522; Fligor, U. S. Pat. 2,181,478; Smith, U. S. Pats. 2,182,827, 2,184,444; Bruson, U. S. Pat. 2,187,-566; Kauppi, U. S. Pat. 2,188,903; Lipkin, U. S. Pat. 2,192,921; Jacobson, U. S. Pat. 2,199,789; Warner, Can. Pat. 385,103; Reilly, Can. Pat. 385,754; French Pats., 842,339, 842,491, 844,709; Arbuzov, Russ. Pat. 50,992.
20. Compositions, sheets and films: McClurg, U. S. Pat. 2,176,091; Semon, U. S. Pat. 2,176,153; Blackard, U. S. Pats. 2,177,633, 2,177,658, 2,177,-660, -1; Britton, U. S. Pat. 2,179,975; Smith, U. S. Pats. 2,182,359, -361, -2, -3, 2,184,155, -423, -426, -442, -3, -5; Carver, U. S. Pat. 2,182,371; Wiley, U. S. Pats. 2,183,602, 2,205,449; Currie, U. S. Pat. 2,196,577; Waterman, U. S. Pat. 2,198,927; Mack, Can. Pat. 385,484; Monsanto, Brit. Pats. 509,596, 509,696, 511,419.
21. General Reviews: Books on High Polymers by Interchemical Publishers, N. Y.: I, Collected Papers of Wallace Carothers; II, Mark: Physical Chemistry of High Polymeric Systems; III, Mark and Raff: High Polymeric Reactions—Theory and Practice; IV, Meyer: Natural and Synthetic High Polymers. Staudinger *et al.*, Fortschritte Chem., Physik., U. Tech. Makromolekular Stoffe 1939, 331 pp., Lehmanns, Munich. Fortune, *22*, 89.
22. Properties of Thermoplastics: Bateson, J. App. Phys. *10*, 887–9; Russell, J. I. E. C., *32*, 509–12; Jenckel, Z. Phys. Chem. *A185*, 465–8, C. A. *35*, 2954; A. S. T. M. Symposium of Thermal Insulating Materials; Bartoe, Mech. Eng., *61*, 892–4; Delmonte, MODERN PLASTICS *17*, 65–8; Meyer, A. S. T. M. Bull. *105*, 23–6; Hartshorn, J. Soc. Ch. Ind. *59*, 129–33; Frölich, Kunststoffe *30*, 10–12; Kunststoffe *29*, 284; Blom, Koll. Z. *90*, 201–4.
23. Adrianov, Org. Chem. Ind. (Russ.) *6*, 203–7. Rochow and Gilliam, Polymeric Methyl Silicon Oxides, Detroit Meeting, American Chem. Soc.
24. Fr. Pat. 840,900.
25. Symposium, J. I. E. C. *32*, 1151. Frölich, *et al.*, J. I. E. C. *32*, 1281. North, Chem. & Met. *47*, 220.



COURTESY, DETROIT MACCHO CORP., AND TENNESSEE EASTMAN CORP.

Continuous extrusion of cellulose ester plastics (top) showing rod as it is conveyed from the screw-type machine head. Various types of extruded rods, strips and tubes of varying diameter, shape and cross section are pictured directly above

Cellulose esters

by C. H. PENNING*

CONSUMPTION of cellulose ester molding compositions continued to increase during 1940. It is estimated that shipments for the year were approximately 14,000,000 pounds, compared with the 10,580,342 pounds reported by the Bureau of the Census for the year 1939.

The most notable development in connection with the cellulose ester plastics during 1940 was the increase of interest in continuous extrusion. It is anticipated that the growth of this type of work will rival that of injection molding. The appearance early in the year of woven matting replacing reed in furniture attracted wide attention. Brilliant hues appeared in chairs and tables for porch and lawn, with pastels and clear transparent for indoor use. In addition to the bright shiny surface, the appeal of the extruded strip in this use lies in the absence of jagged edges so common

* TENNESSEE EASTMAN CORP.

COURTESY, CELLULOID CORP

Transparent acetate extruded strips are woven into attractive chair seats and backs

in reed, causing tearing of clothing, especially stockings.

Extruded strips of course need not be flat; quite complicated profiles can be produced. A very useful product of this nature is made in a variety of sizes and shapes for sealing the butting edges of wallboard, inserts on sheet metal, etc. Tubes and rods can be made with equal facility; the diameter thus far has been restricted by the equipment available.

Coating of wire by extrusion for insulation and for decorative effect is another line of development. Lack of equipment has retarded progress thus far, but this handicap is rapidly being remedied.

Cellulose ethers

by S. L. BASS AND A. E. YOUNG*

THE past year has seen notable advances in the utilization of the two cellulose ethers with which the plastics and coating industries are principally concerned. Since space does not permit an outline of the year's progress in the water-soluble methylcellulose, this review will consider only the solvent soluble cellulose ethers, as typified by ethylcellulose.

Molding plastics

Ethylcellulose plastics specifically designed for extrusion molding were introduced during the year. They are easy to mold, dimensionally stable, resistant to fatigue or shock and have good outdoor durability. These properties make ethylcellulose plastics unusually interesting for a wide variety of extruded shapes including woven plastic webbing for furniture.[1]

New ethylcellulose injection molding plastics have been developed during the year. They now meet rigorous requirements for durability, low temperature flexibility and toughness. The water absorbed by two ethylcellulose plastics typical of 1939 production has been reported in a careful study of the water sorption of commercial plastics.[2] Accelerated weathering tests have also been reported[3] which compare laboratory samples of transparent ethylcellulose plastics with commercial samples of other plastics. Composition floor tiles compression molded from ethylcellulose plastic[4] and two molding lubricants have been described.[5] Coating molds with ethylcellulose is claimed to prevent adhesion of hard rubber moldings.[6] A fundamental advance in injection molding promises to come from the application of induction heating to soften the plastic granules in the heating cylinder of the injection press.[7]

Ethylcellulose is now recognized to be one of the important base materials for plastics. As a derivative of cellulose, its strength, toughness and flexibility are inherent in its long chain-like structure. Its moldability and compatibility with solvents and plasticizers may be adjusted to conform to diversified requirements for plastic uses by tailoring the length of the cellulose molecule and by varying the degree to which the cellulose is etherified.[8]

COURTESY, DOW CHEMICAL CO.

*Miniatures of the "City of Midland," new Lake Michigan ferry are injection molded of ethylcellulose and the masts are extruded. Parts are cemented together with a special adhesive. Plastic waves are drawn from sheet stock**

Transparent sheeting

Ethylcellulose sheeting was found to be particularly suited to the manufacture of rigid transparent containers and sales displays.[9] Its unusual flexibility, toughness and ductility adapt it to all types of fabrication methods.[10,11] New machines especially designed for thermoplastic sheets now (*Please turn to page 94*)

* DOW CHEMICAL CO.

* Injection molding by Michigan Molded Plastics, Inc.; Extrusion by Pierce Plastics, Inc.

1. MODERN PLASTICS, June 1940, pp. 74–75.
D. L. Gibb, MODERN PLASTICS, July 1940, p. 54.
2. G. M. Kline, A. R. Martin, and W. A. Crouse, MODERN PLASTICS *18*, 119 (1940).
3. G. M. Kline, W. A. Crouse, and B. M. Axilrod, MODERN PLASTICS Aug. 1940, p. 49.
4. L. Light, British Plastics *11*, 350 (Jan. 1940).
5. U. S. Pats. 2,215,249 and 2,215,250, W. W. Pederson to The Dow Chemical Company.
6. U. S. Pat. 2,201,271, E. G. Partridge to The B. F. Goodrich Co.
7. Brit. Pat. 523,013, Celluloid Corp.
8. E. Ott, Ind. Eng. Chem. *32*, 1641–47 (1940).
9. S. L. Bass and F. C. Dulmage, Jr., Modern Packaging, Sept. 1940, p. 88.
10. Modern Packaging Catalog, 1940.
11. Packaging Parade, Dec. 1940.
12. Packaging Parade, Dec. 1940.

Plastic Forecast

SHOWERS— CHANGING TO TENITE

Shower nozzles molded by Thermo-Plastics, Inc., for Mueller Brass Co. ➔

TENITE brings color, modern styling, and efficiency to the new Streamline shower nozzle—the first ever to be made of a plastic material.

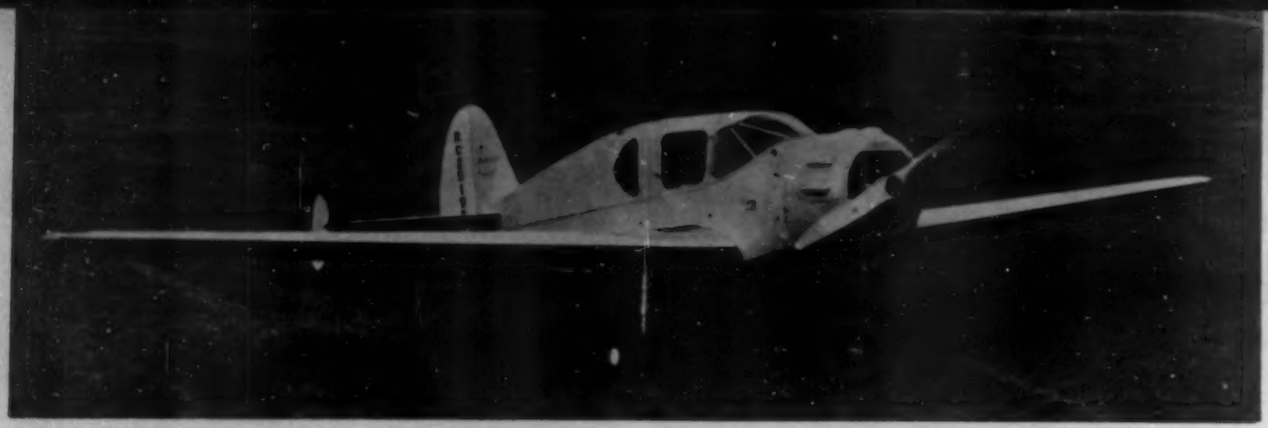
Precision-molded discs with serrated edges give a fine needle-point spray, the direction of which can be accurately controlled by adjustment of the Tenite head on its swivel mounting.

TENITE is a non-corrosive and exceptionally durable material. Its lustrous finish will not tarnish or become dull with wear—its colors cannot chip off because they are an integral part of the material itself. Tenite has proved suitable for countless articles of home furnishings—including doorknobs, light switches, kitchen accessories, bathroom fixtures, and furniture.

A 28-page illustrated book describing the many properties and uses of Tenite will be sent on request.

TENITE REPRESENTATIVES: *New York*, 10 East 40th St. *Buffalo*, 1508 Rand Building. *Chicago*, 2264 Builders' Building. *Detroit*, 904-5 Stephenson Building. *Leominster, Mass.*, 39 Main St. . . . Pacific Coast: Wilson & George Meyer & Company—*San Francisco*, Federal Reserve Building; *Los Angeles*, 2461 Hunter St.; *Seattle*, 1020 4th Ave., South.

TENNESSEE EASTMAN CORPORATION
Kingsport, Tenn. *Subsidiary of the Eastman Kodak Co.*



1

This Bellanca Cruisair makes use of low temperature phenolic resin for bonding the plywood wing panels

Phenolic resin bonded airplane*

by H. N. HAUT†

Synthetic resins play an increasingly important role in airplane construction

THE resin bond in plywood which definitely fixed its rehability has reawakened the interest of the wood-minded engineers, with the subsequent and ever-increasing appearance of plywood structures. The long time exposure tests by Brouse covering a period of four years at the Forest Products Laboratory has gone far to establish the durability, water resistance, and resistance to parasitic growths, of the phenolic bond.

The desirability of using plywood in place of metal in certain applications is best illustrated by examining a typical stressed skin wing or a typical monocoque fuselage of metal. It is seen that even the most ingenious design cannot avail itself of the full compressive strength of the metal, which fails by local buckling before the ultimate metal strength is reached. We, therefore, find a variety of stiffeners, in the form of angles, channels and corrugations, used to support the unstable skin. They must also be rigidly attached to the skin with closely spaced rivets and with a corresponding increase in the drag of the surface.

Now Clark has shown that for a given weight a thicker shell of lower density material without stiffeners will support a greater stress than a thin metal shell with stiffeners and upon this thesis is founded one of the plastic airplanes of today. Add to these findings and to the research already discussed, a continued improvement in the technique of forming compound curves of plastics reinforced wood, and a utilization of the plastic properties of the plastics, that is, its susceptibility to forming and to remain formed (I refer now to the irreversible thermosetting resins) and we have, by a natural succession of events, arrived at the plastic airplane.

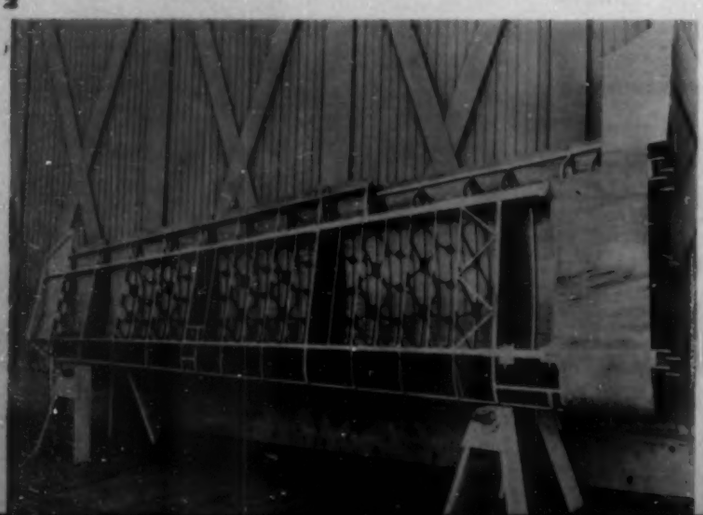
There has appeared in the (*Please turn to page 98*)

* This article is abridged from the paper, "Synthetic resins in airplane construction," presented by Mr. Haut at the Lehigh University symposium on the industrial applications of plastics, Bethlehem, Pa., October 1940.

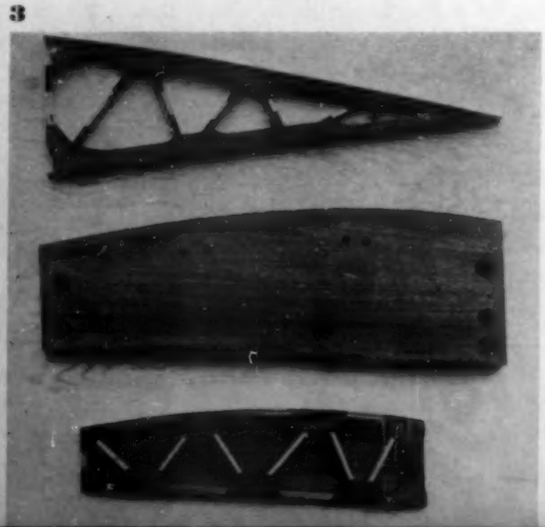
† Chief Inspector, Bellanca Aircraft Corp.

2—*Cross sectional view of wing panel shows internal construction.* **3**—*Samples of phenolic bonded test specimens demonstrate the strength and durability of these wing parts even after severe tests*

2



3



FOR MORE than fifteen years, Molds and Plastic Molded Parts made by us have borne this CHICAGO MOLDED PROD CORP mold mark. It is our signature of authorship — our acknowledgment of responsibility — and we are proud of it. If, like the sterling mark on silver, it has become the hallmark of quality for Plastic Molded Parts, it is because we have consistently held to the highest standards in our work. Leading manufacturers of Radios, Automobiles, Electrical Devices, Household Appliances, Scientific Instruments, etc., who have bought millions of our Plastic Molded Parts, attest their quality. If you are interested in the use of better Plastic Molded Parts, we invite your inquiries.

CHICAGO MOLDED PRODUCTS CO.

1046 No. Kolmar Ave. **Chicago, Ill.**

Plastics Digest

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastics materials or use them. Requests for copies of the magazines mentioned should be directed to the individual publishers whose addresses will be mailed upon receipt of a self-addressed stamped envelope.

General

UTILIZATION OF LIGNIN. E. C. Jahn. News Edition A.C.S. *18*, 993–6 (Nov. 25, 1940). A summary of the present industrial status of lignin. In spite of extensive studies on the nature and utilization of lignin only very small amounts find commercial use. The different types of lignin products for plastics result in materials with varying properties, and what has been produced apparently represents an incomplete stage in development of lignin plastics.

CHRYSLER RUBBER-PLASTICS LABORATORY. J. C. Zeder. Rubber Age *48*, 19–22 (Oct. 1940). The functions and equipment of this laboratory are described.

MAKING FABRICS TRANSPARENT AND IMPERMEABLE TO FLUIDS. C. H. S. Tupholme. News Edition A.C.S. *18*, 766 (Sept. 10, 1940). A new process has been developed by Imperial Chemical Industries for making fabrics transparent and impermeable to fluids and at the same time increasing their gloss. It consists of impregnating the fabric with nondrying-oil- or semidrying-oil-modified alkyd resins in conjunction with urea–formaldehyde condensation products.

THE PHENOMENON OF FLUORESCENCE. H. E. Millson. Am. Dyestuff Reporter *29*, 579–82 (Oct. 28, 1940). A review of the nature of fluorescence and of its commercial applications, including incorporation of fluorescent materials in plastics. This article is available in full in Technical Service Bulletin No. 571 of the Calco Chemical Division of the American Cyanamid Corporation.

Materials and Manufacture

FILLERS IN PLASTICS. P. Grodzinski. Plastics *4*, 253–7 (Nov. 1940). The influence of the particle size and shape of fillers and of the type and amount of resin on the physical properties of plastic compositions are considered. The microstructures of various resin-filler masses were investigated. The degree of flow in the mold and the time of pressing were found to be important factors in the separation of fillers from resin and in the particle-size distribution of the filler throughout the molded part.

Molding and Fabricating

HARD PLASTING OF PLASTIC MOLDS. A. W. Logozzo. Metal Finishing *38*, 579–84 (Nov. 1940). The following qualifications are adjudged necessary for continued successful chrome plating of molds: Correct hardness of base (Rockwell C56); highly polished, defect-free surface; perfect adhesion; uniform deposit; minimum thickness of 0.001 inch; file hard surface. The advantages of plating molds from the molder's viewpoint are: Corrosion resistance; free extraction of molded part; higher finish of molded part; longer wearing life of mold; better flow of compound; uniformity of molded pieces over a long period.

PLASTIC SYRUP HEATING. H. Van Wyk. Electrical West *85*, 55 (Oct. 1940). Tanks used by the Colotyle Corp. for electrically heating plastic syrups for application to prestwood moldings and other products by spray or dip processes are described.

Applications

REMOVAL OF CHLORIDES AND SULFATES BY SYNTHETIC RESINS. M. C. Schwartz, W. R. Edwards, Jr., and G. Boudreaux. Ind. Eng. Chem. *32*, 1462–6 (Nov. 1940). A resin prepared by condensation of *m*-phenylenediamine with formaldehyde in the presence of hydrochloric acid was tested to determine the effects of drying time, temperature of water, particle size, initial concentration and total acidity on the removal of chlorides and sulfates from aqueous solutions.

PLANNING PLASTIC DISPLAYS. J. G. Lippincott. Modern Packaging *14*, 75–6, 106, 108 (Sept. 1940). New display technics are being developed to utilize unique characteristics of plastics.

MIXTURE OF BAKELITE AND METAL POWDER FOR MOUNTING MICRO SPECIMENS. N. J. Finsterwalder. Metal Progress *38*, 294–5 (Sept. 1940). Experimental procedure for mounting metal specimens in thermosetting resins is described.

NYLON FILAMENTS FOR INDUSTRIAL BRUSHES. Product Eng. *11*, 552–4 (Dec. 1940). First experiments with nylon for brush bristles began in 1938 and the following year saw its introduction in tooth brushes and industrial brushes. Selection of filaments and cores and methods of construction are discussed in this article. Nylon bristles are higher in cost than high grade hog bristles, but this may be offset by the increased life of the brush in certain applications.

NEW TEXTILE FIBERS, FABRICS, AND FINISHES. Ind. Eng. Chem. *32*, 1543–71 (Dec. 1940). This is a group of eight papers presented at the Detroit meeting of the American Chemical Society in Sept. 1940. The titles and authors of the papers are as follows: "Resins and plastics for the modification of textile fabrics," by D. H. Powers; "Natural protein-base spun fibers," by F. C. Atwood; "Soybean protein fibers—experimental production," by R. A. Boyer; "Electrocoated pile fabrics," by N. E. Oglesby and L. E. Hoogstoel; "Cellulose acetate rayons —types, properties, and uses," by H. D. Smith; "Nylon as a textile fiber," by G. P. Hoff; "Vinyon," by F. Bonnet; and "Fiberglas—new basic raw material," by G. Slayter.

Properties and Testing

MEASUREMENT OF SOLID FRICTION OF PLASTICS. A. Gemant. J. Applied Physics *11*, 647–53 (Oct. 1940). A method to measure the vibrational damping of plastic materials is described. Three materials were tested: glass, polystyrene and paraffin wax.

DIELECTRIC PROPERTIES OF ORGANIC COMPOUNDS. S. O. Morgan and W. A. Yager. Ind. Eng. Chem. *32*, 1519–28 (Nov. 1940). In plastics the polymer molecules as a whole are too large to rotate, but motion of polar groups may be possible. Such motions appear to be sufficient to explain observed values of dielectric constants in plastics.

PHTHALIC ANHYDRIDE DETERMINATIONS IN ALKYD RESINS. J. M. Sanderson. A.S.T.M. Bulletin *1940*, 15–6 (Dec.). The Kappelmeier and Navy methods were tried in six laboratories on the same resins. Better agreement among the different laboratories and with calculated results were obtained by the former method and it has been adopted as a tentative standard by the American Society of Testing Materials.

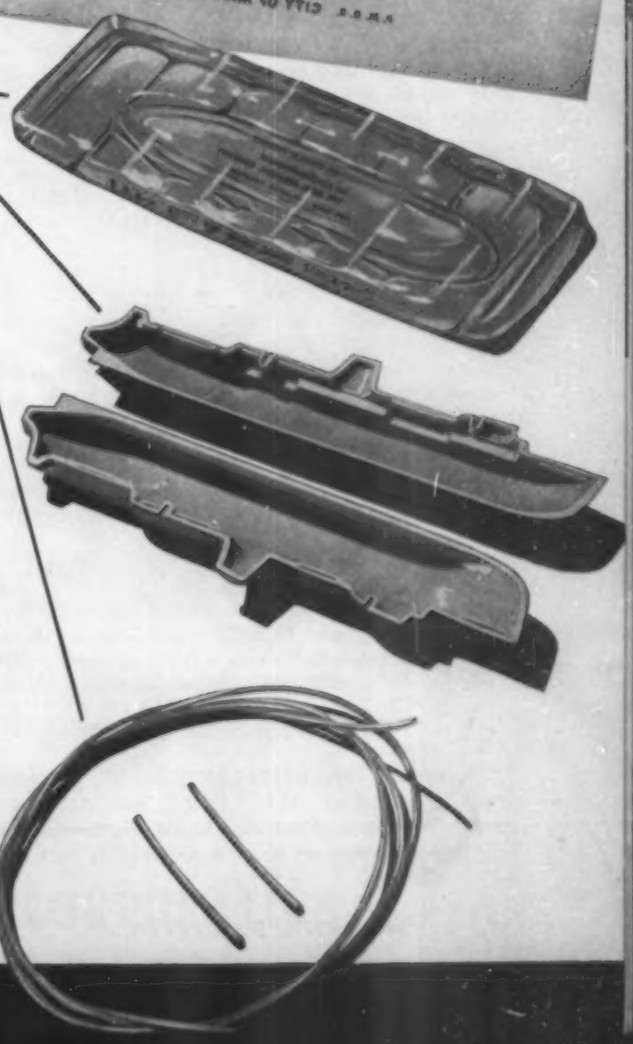
Ethocel is Versatile!

Plastic souvenir presented to guests at launching of "City of Midland," new Pere Marquette R.R. car ferry, Sept. 18, 1940, at Manitowoc, Wisconsin.

TRANSPARENT DRAWN ETHOFOIL

INJECTION MOLDED ETHOCEL PLASTIC

EXTRUDED ETHOCEL PLASTIC



The progress made in the successful fabrication and use of ETHOCEL* is aptly demonstrated by the plastic ship model of the "City of Midland" shown above—a combination of transparent sheeting with molded plastics. The model of injection molded ETHOCEL has extruded ETHOCEL rod for its radio masts and rides transparent plastic waves of drawn ETHOFOIL.*

ETHOFOIL is made of ETHOCEL. It is available in sheets or continuous rolls in thicknesses up to .0200".

ETHOCEL Plastic has a wide variety of applications and its characteristics fit many fabricating requirements. It molds with a high gloss and retains its finish under ordinary conditions. Moldings resist weather, light, heat and aging and possess unusual dimensional stability. ETHOCEL Plastic granules are available in the usual commercial grades and in extra tough grades for special jobs. They are supplied in a wide range of light stable colors.

For more complete information and specifications on ETHOCEL Plastics and ETHOFOIL write to the Cellulose Products Division of

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

Branch Sales Offices: New York City, St. Louis, Chicago, San Francisco, Los Angeles, Seattle

*Trade Mark Reg. U. S. Pat. Off.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

PHENOL-CELLULOSE RESIN. L. E. Champer (to Chemical Foundation, Inc.). U. S. 2,220,062, Nov. 5. Pure cellulose, prepared from castor bean stalks by treatment with dilute nitric acid, is condensed with phenol to form a thermosetting resin.

SLIDE FASTENERS. D. Marinsky (to Whitehall Patents Corp.). U. S. 2,220,136, Nov. 5. Thermoplastic coupling links of slide fasteners are cemented to the fabric backing by means of a solvent where end stops are desired.

SANDPAPER. H. G. Bartling and E. B. Overshiner (to Minnesota Mining & Mfg. Co.). U. S. 2,220,140, Nov. 5. Sheeting a plastic material, solidifying the under side of the sheet and applying abrasive grains to the top surface before it solidifies.

DIENE POLYMERS. N. K. Chaney (to United Gas Improvement Co.). U. S. 2,220,211, Nov. 5. Passing boron trifluoride gas into a solution of cyclopentadiene and stopping the reaction while the polycyclopentadiene is still in the soluble stage.

VOLTOLIZED OIL. R. Rosen (to Standard Oil Development Co.). U. S. 2,220,287, Nov. 5. Making plastic and rubber-like elastic polymers by voltolizing high-boiling unsaturates formed by dehydrogenating paraffin wax.

OIL-SOLUBLE RESIN. A. N. Sachanen and P. G. Waldo (to Socony-Vacuum Oil Co.). U. S. 2,220,290, Nov. 5. Making an oil-soluble resin from petroleum solvent tar by condensation with formaldehyde.

UREA RESIN. A. W. Kassay (to Plaskon Co.). U. S. 2,220,337, Nov. 5. Making a thermosetting molding composition from a urea-formaldehyde resin and a plasticizer derived from dimethylolurea.

PROTEIN PLASTIC. P. Esselmann and J. Düsing (to Walther H. Duisberg). U. S. 2,220,441, Nov. 5. Condensing a protein with ethyleneimine and polymerizing the product with an aryl isocyanate or isothiocyanate.

COLLAR FABRIC. T. A. Kauppi and R. R. Bradshaw (to Dow Chemical Co.). U. S. 2,220,525, Nov. 5. As interliner in laundry-fast laminated fabrics a fabric ply coated with a plasticized blend of a cellulose ether and an acrylate-methacrylate interpolymer.

WELDING THERMOPLASTICS. R. C. Reinhardt (to Dow Chemical Co.). U. S. 2,220,545, Nov. 5. Joining sheets of a synthetic thermoplastic with the aid of a thermoplastic welding rod and a flameless jet of a hot gas which is inert to the plastic material.

PRINTING INK. C. Ellis (to Ellis Laboratories, Inc.). U. S. 2,220,621, Nov. 5. A heat-drying printing ink containing a resin derived from a glycol and maleic, fumaric, citraconic or itaconic acid.

ALKYD RESIN EMULSION. R. J. Myers and H. C. Cheetham (to Resinous Products & Chemical Co.). U. S. 2,220,685, Nov. 5. Emulsifying a drying oil modified alkyd resin in a casein dispersion to form a water-in-oil emulsion with high solids content.

CASEIN COATING. F. C. Atwood (to Atlantic Research Associates, Inc.). U. S. 2,220,700, Nov. 5. A casein coating composition, also useful for foam abatement, contains an alcohol which is partially soluble in water.

CRAYON. I. Chesler (to Eagle Pencil Co.). U. S. 2,220,992, Nov. 12. A binder for pencil or crayon rods comprises water-soluble cellulose ether and stringy fragments of water-insoluble cellulose ether.

ISOBUTYLENE RESIN. W. E. Kuentzel and W. L. Webb (to Standard Oil Co. of Indiana). U. S. 2,221,000, Nov. 12. Forming resins from isobutylene by polymerization in presence of boron trifluoride at pressures greater than 5000 lb. per sq. in.

ACETAL RESIN. H. B. Smith (to Eastman Kodak Co.). U. S. 2,221,031, Nov. 12. Plasticizing polyvinyl acetal resins with diethyleneglycol ditetrahydrofuroate.

ACETAL RESINS. D. R. Swan (to Eastman Kodak Co.). U. S. 2,221,032-3-4-5-6, Nov. 12. Plasticizing polyvinyl acetal resins with butoxyethyl butoxyacetate, di-isoamyl sulphone, amyl succinate, dialkyl maleates or ethoxyethyl maleate to form transparent rubbery foils.

STAIR TREAD COVERS. H. M. Austin (to Crown Cork and Seal Co.). U. S. 2,221,038, Nov. 12. A molded stair tread cover having a resilient portion and a less resilient nonslip portion.

OINTMENT BASE. G. D. Hiatt (to Eastman Kodak Co.). U. S. 2,221,139, Nov. 12. Use of cellulose butyrate or a higher cellulose ester, with at least 50 percent acyl content, in ointments.

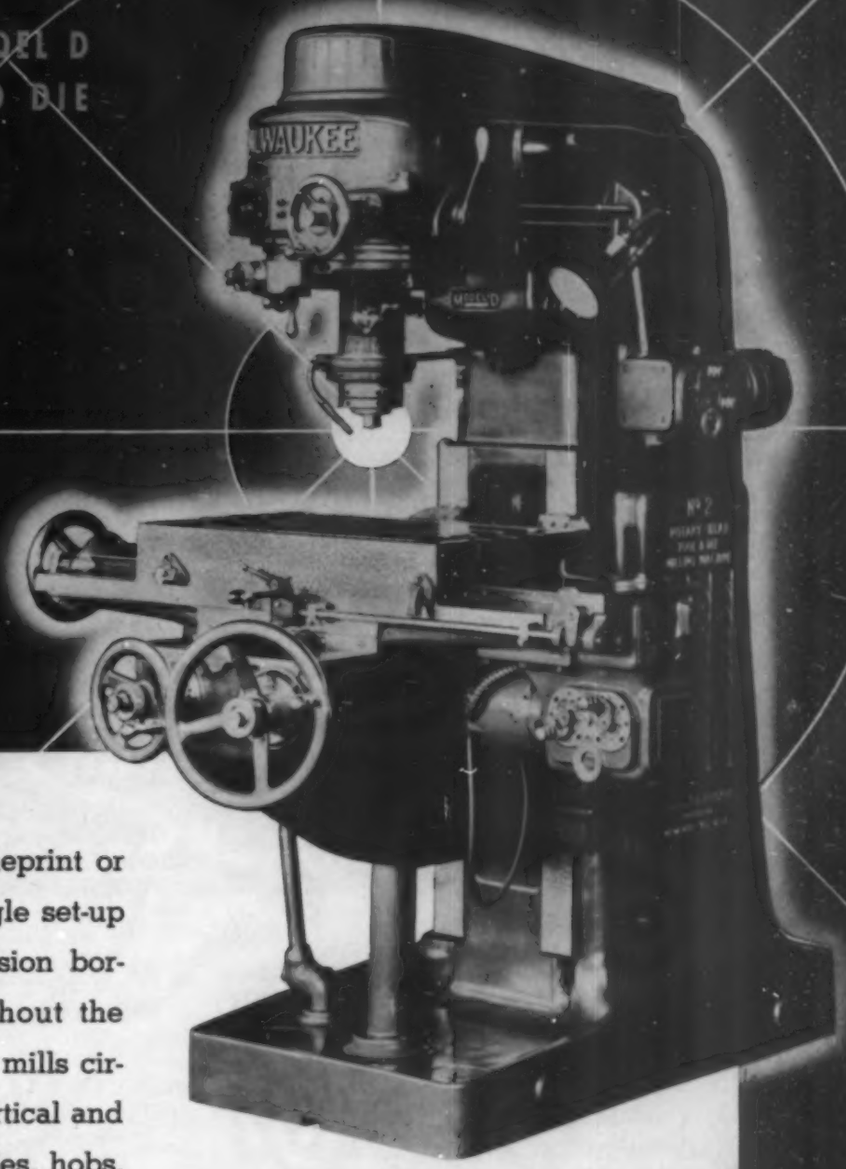
LIGNIN-PHENOL RESIN. L. E. Champer and L. M. Christensen (to Chemical Foundation, Inc.). U. S. 2,221,282, Nov. 12. Condensing phenol with lignin to form a fusible, soluble resin and completing the condensation under pressure to produce an infusible, insoluble resin. *(Please turn to next page)*

MAKE PRECISION DIES, HOBS, MOLDS

more rapidly-more accurately

IN A SINGLE SET-UP

WITH THE MILWAUKEE MODEL D
ROTARY HEAD TOOL AND DIE
MILLING MACHINE



A MACHINE that transmits blueprint or drawing into steel—in a single set-up — layout, milling, drilling, precision boring and slotting operations without the use of models and templates . . . mills circular and angular cuts in both vertical and horizontal planes — completes dies, hobs, molds without resetting of machine and with unprecedented speed and accuracy . . . Send for Bulletin No. 1002 giving full information on the Milwaukee Model D — Rotary Head Tool and Die Milling Machine.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U.S.A.

SAFETY GLASS. F. L. Bishop, R. H. Du Bois and P. Finnegan (to American Window Glass Co.). U. S. 2,221,367, Nov. 12. Flowing a film of interlayer onto a sheet of glass and joining the coated sheet to another sheet of glass.

CELLULOSIC PLASTIC. Fred J. Heckel. U. S. 2,221,378, Nov. 12. Plasticizing a cellulose ester with wood tar and heating at 200–220 deg. C. to distill off volatile components from the plasticizer.

THIODIGLYCOL RESIN. A. Weihe (to General Aniline & Film Corp.). U. S. 2,221,418, Nov. 12. Condensing a thiodiglycol with maleic anhydride to form an insoluble resin.

WATERPROOF BOARD. G. W. Clarvoe and L. A. H. Baum (to Johns Manville Corp.). U. S. 2,221,420, Nov. 12. Impregnating plasterboard with a polyolefin resin.

COATED FABRIC. R. E. Burnett (to General Electric Co.). U. S. 2,221,440, Nov. 12. Coating and impregnating fabrics with a resin formed by condensing an aromatic compound with a halogenated alkaryl ester.

WOOD OIL RESIN. E. F. Fiedler and A. F. Shepardson (to General Electric Co.). U. S. 2,221,511, Nov. 12. Making a potentially reactive resin by acid condensation of formaldehyde with a mixture of phenols comprising wood oil and a phenol which is more active than wood oil.

POLYSULPHIDE POLYMER. J. C. Patrick (to Thiokol Corp.). U. S. 2,221,650, Nov. 12. Hot press molding of a cured polymer derived from a polysulphide and a disubstituted organic compound.

POLYESTERS. H. S. Rothrock (to E. I. du Pont de Nemours and Co.). U. S. 2,221,662–3, Nov. 12. Forming resins by polymerizing propargyl fumarate or dimethallyl maleate.

UREA RESIN. T. S. Hodgins and A. G. Hovey (to Reichhold Chemicals, Inc.). U. S. 2,221,708, Nov. 12. A resin suitable for baking varnishes is made by condensing urea with formaldehyde in presence of ammonia.

ACID-RESISTANT RESINS. W. R. Collings, R. D. Freeman and R. M. Upright (to Dow Chemical Co.). U. S. 2,221,778–9, Nov. 19. Making acid-resistant thermosetting resins by condensing lignin or lignocellulose with a phenol and then with an aldehyde.

MOLDABLE SHEET. N. D. Hanson (to Union Carbide and Carbon Corp.). U. S. 2,221,945, Nov. 19. Mixing a long fiber pulp with a thermosetting resin having a short fiber filler, and forming the product in sheets.

SOUND RECORD. A. E. Schuh (to Bell Telephone Laboratories, Inc.). U. S. 2,221,956, Nov. 19. A sound record composition containing stearic acid 60, montan wax 13, anhydrous sodium carbonate 5, basic lead carbonate 8 and plasticizer 14 percent by weight.

UREA RESIN. H. Goldschmidt and O. Neuss (to American Cyanamid Co.). U. S. 2,222,028, Nov. 19. A resin suitable for molding is made from urea and formaldehyde by acid condensation.

LACQUER BASE. A. Blömer and W. Becker (to I. G. Farb. Akt.). U. S. 2,222,345, Nov. 19. Emulsion polymerization of butadiene in presence of an inhibitor which improves the plasticity of the polymer and chlorination of the product.

CURING RESINS. R. B. Barnes (to American Cyanamid Co.). U. S. 2,222,470, Nov. 19. In curing a thermosetting resin samples are withdrawn for rapid curing tests from which the end point of the cure is estimated.

ACETAL RESIN. H. F. Robertson (to Carbide and Carbon Chemicals Corp.). U. S. 2,222,490, Nov. 19. Plasticizing polyvinyl partial acetal resins with dialkyl ethers of polyethyleneglycols.

UREA RESIN INTERMEDIATE. T. S. Hodgins and A. G. Hovey (to Reichhold Chemicals, Inc.). U. S. 2,222,506, Nov. 19. Condensing urea with formaldehyde in presence of butanol.

PRINTING TEXTILES. H. Jenett (to Interchemical Corp.). U. S. 2,222,581–2, Nov. 19. Incorporating in printing pastes for textiles a thermosetting resin which is set by heat after the paste is applied to fabric.

TREATING RESINS. Leo Robin and Mathieu van Roggen. U. S. 2,222,686, Nov. 26. Dissolving an incompletely polymerized resin in alcohol in presence of a soap and dispersing the solution in an aqueous fibrous pulp to form a molding composition.

BOTTLE CAP. H. O. Hoffman (to Faultless Rubber Co.). U. S. 2,222,771, Nov. 26. A molded bottle cap, fitted so that it seals the opening when screwed down tight.

PHOTOELECTRIC CELL. Enrique G. Touceda and John D. Lee, Jr. U. S. 2,222,788, Nov. 26. Sealing the light-sensitive element of a photoelectric cell wholly within a block of highly transparent methyl methacrylate resin.

VINYL RESIN. C. H. Alexander (to B. F. Goodrich Co.). U. S. 2,222,928, Nov. 26. A polyvinyl halide plastic containing a sulphur-free lead compound and sulphur or a sulphide.

COATED PAPER. J. H. Seaton (to B. F. Goodrich Co.). U. S. 2,222,956, Nov. 26. Calendering a film of plasticized gamma polyvinyl chloride gel to a sheet of paper.

DIENE POLYMERS. H. Wollthan and W. Becker (to Jasco, Inc.). U. S. 2,222,967, Nov. 26. Emulsion interpolymerization of butadiene with other polymerizable compounds.

CAN LINING. P. M. Clark and C. B. Hemming (to E. I. du Pont de Nemours and Co.). U. S. 2,223,026, Nov. 26. Lining beer cans or food tins with an alkyd resin priming coat and a plasticized nitrocellulose top coat. (*Please turn to next page*)

Lens and Light Click perfectly—
thanks to PHENOLITE *and* NATIONAL VULCANIZED FIBRE

• *Above* are a few of the key posts in the Chardelle Meteor Flash-where Phenolite and National Vulcanized Fibre do yeoman service in assuring perfect synchronization between shutter and flash for better pictures. The Chardelle Meteor Flash is made by Chardelle, Inc., 360 Furman St., Brooklyn, N. Y. and distributed exclusively by American Bolex Company, Inc.

• *At Left*—The Westinghouse Mazda Photolamp Exposure Calculator is made of tough white National Vulcanized Fibre with a special surface for printing ink. (Weston Emulsion Ratings appear on the reverse side.)

THE CHARDELLE **METEOR FLASH** . . . a new synchronizer for shooting flash pictures, brings new opportunities to camera fans because of its smooth performance and extremely low price. Its features are many: automatic safety retractable plunger; quick bulb change, sure contact socket; synchronization at any shutter speed with any bulb, etc.

• The National Vulcanized Fibre and Phenolite, laminated bakelite, insulating parts—thanks to their high electrical, mechanical properties and durability—are key factors in the perfect synchronization and long life of the Chardelle Meteor Flash. Both Phenolite and National Vulcanized Fibre possess outstanding qualities which make them practical in countless uses. They are available in sheets, rods, tubes and special shapes.

• Perhaps there is a place where you can use these versatile materials. Our technical staff's broad experience in the application of these remarkable products is available to you on any problem.

NATIONAL VULCANIZED FIBRE COMPANY

FOUNDED 1873

WILMINGTON, DELAWARE

Offices in All Principal Cities

MOLDING. A. Fuchs (to H. Römmler Akt.). U. S. 2,223,-034, Nov. 26. Apparatus for preheating tablets of resin composition prior to molding.

CASEIN RESIN. John J. Murray. U. S. 2,223,120, Nov. 26. Reacting casein with urea, thinning with ammonia and cooking the paste to form a resinous product.

RUBBER SUBSTITUTE. P. J. Gaylor (to Standard Oil Development Co.). U. S. 2,223,171, Nov. 26. A hard brittle unvulcanized vinyl high polymer having dispersed therein a polymerization inhibitor.

PREVENTING TARNISH. D. W. Light and L. P. Moore (to American Cyanamid Co.). U. S. 2,223,327, Nov. 29. Protecting silver and brass from tarnish by a hard clear coating of a castor oil modified alkyd resin and a butylated melamine-formaldehyde resin.

TRIM. D. M. Anderson (to Standard Products Co.). U. S. 2,223,346, Dec. 3. Making a unitary decorative window automobile trim frame from a thermoplastic.

ABRASIVE. R. L. Smith (to Carborundum Co.). U. S. 2,223,392, Dec. 3. An alkali-treated phenolic resin as a binder for abrasive grains.

BILLIARD BALL. W. R. Thompson (to Catalin Corp. of America). U. S. 2,223,394, Dec. 3. A billiard ball has an elastic, resilient core of phenolic resin with water dispersed through it, and a thermally dehydrated case-hardened nonstaining skin of the same resin.

TRIM. J. S. Reid (to Standard Products Co.). U. S. 2,223,-459, Dec. 3. A molded thermoplastic decorative trim for automobile windows also serves as a frame and weather seal for the window.

PROPELLER. Wm. H. Moss (to Celanese Corp. of America). U. S. 2,223,527, Dec. 3. Bonding a cover of cellulose acetate sheeting to an airplane propeller under fluid pressure while in contact with ethylcellulose, then stripping away the ethylcellulose.

UREA RESIN. Leonard Smidth. U. S. 2,223,536, Dec. 3. Making a hard tough gel of stable glass-clear, urea-formaldehyde resin by acid condensation in a solution boiling under a reflux condenser.

MOLDED ARTICLES. Wm. I. Taylor and L. B. Gibbins (to Celanese Corp. of America). U. S. 2,223,538, Dec. 3. Molding cellulose acetate or polyvinyl acetate articles in a mold faced with an alkaline dressing to cause superficial hydrolysis of the plastic.

CASHEW NUT PRODUCT. Solomon Caplan. U. S. 2,223,548, Dec. 3. Polymerizing cashew nut shell liquid in presence of tributyl phosphate and pine oil.

CASHEW NUT PRODUCT. M. T. Harvey (to Harvel Corp.). U. S. 2,223,549–50, Dec. 3. Thickening cashew nut shell liquid by heating with a polymerizing agent, then distilling off a phenol with a long chain unsaturated substituent; and condensing the phenol with pine oil.

ADHESIVE. E. C. Pitman (to E. I. du Pont de Nemours and Co.). U. S. 2,223,575, Dec. 3. A thermosetting adhesive with high bonding strength comprising a dispersion of oil modified alkyd resin and nitrocellulose in a solvent.

UREA RESINS. D. E. Cordier (to Plaskon Co.). U. S. 2,223,816–7, Dec. 3. Substituted thiourea derivatives as latent accelerators for urea-formaldehyde resin molding compositions; and similar accelerators comprising ethylenediamine salts of benzoic, succinic or like acids.

UREA RESINS. R. P. Cosgrove (to Plaskon Co.). U. S. 2,223,818, Dec. 3. A latent accelerator for urea-formaldehyde resins is formed by action of benzoyl chloride on lacthydroxamic acid.

ELECTRIC CONDENSER. M. Sander (to Radio Corp. of America). U. S. 2,223,833, Dec. 3. Mica flakes for use in an electric condenser are coated with styrene in such thickness as to give a condenser with constant temperature-capacity characteristic.

CELLULOSE DERIVATIVES. H. Lohmann (to E. I. du Pont de Nemours and Co.). U. S. 2,223,893, Dec. 3. Stabilizing cellulose esters, ethers or ether-esters to sunlight by adding 0.5 to 10 percent of manganous lactate.

SYNTHETIC FIBER. E. L. Martin (to E. I. du Pont de Nemours and Co.). U. S. 2,223,916, Dec. 3. Reacting a bifunctional sulphonamide with a bifunctional amide to form a linear polymer which can be drawn into a fiber.

AMINE RESIN. R. Griessbach, E. Meier and H. Wassenegger (to I. G. Farb. Akt.). U. S. 2,223,930, Dec. 3. Forming a resin from *m*-phenylenediamine and a polymerized alkyleneimine by condensation with formaldehyde.

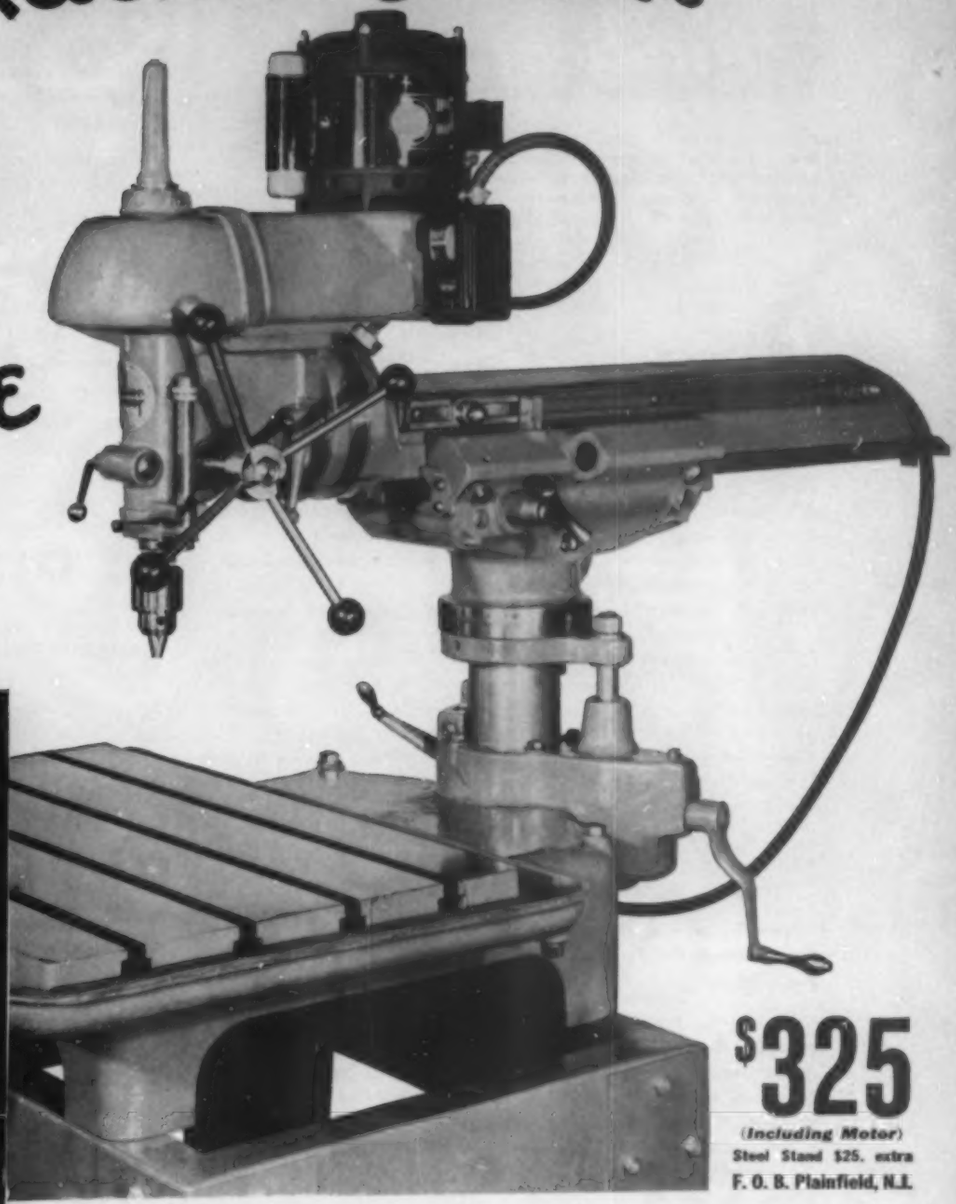
CONTAINER. I. Gurwick (to Shellmar Products Co.). U. S. 2,224,017, Dec. 3. Printing a design in reverse on the inner side of an outer rubber hydrochloride foil, bonding the edges to another similar foil, folding into a container and again bonding the edges.

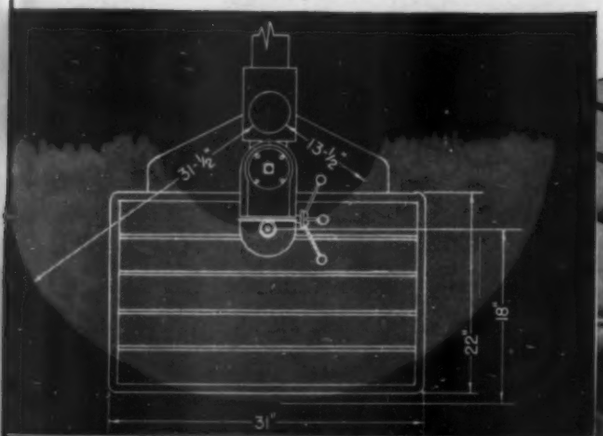
ADHESIVE. J. H. Long (to Hercules Powder Co.). U. S. 2,224,035, Dec. 3. Two resins, formed by esterifying a terpene-maleic anhydride condensate with two different glycols, are blended to form an adhesive for laminating flexible sheet materials.

GARTER. G. S. Van Voorhis (to United Elastic Corp.). U. S. 2,224,036, Dec. 3. A molded thermoplastic hose grip for garters has an extension molded around the elastic webbing of the garter.

INTERPOLYMERS. M. M. Brubaker, R. E. Christ and D. D. Coffman (to E. I. du Pont de Nemours and Co.). U. S. 2,224,037, Dec. 3. Making an ester-amide interpolymer from a diamine, a glycol and a dicarboxylic acid and cold-drawing the product into fibers.

A New Radial Drill At a New Low Price





SPECIFICATIONS

JACOBS CHUCK: 0 to ½" capacity or No. 1 Morse Taper.

TABLE SIZE: 31" x 22", machined surface: 28" x 19".

SPINDLE SPEEDS: four speeds from 600 to 5000 R. P. M. with 1740 R. P. M. ½ H. P. single phase motor. Eight speeds from 600 to 10,000 R. P. M. with two speed 1740-3500 R.P.M. three-phase motor with push-button control.

Height overall: 72"—Width overall: 31"—Depth, front to back: 58"—Shipping weight: 450 lbs.

BALL-BEARING MOUNTED—the sliding ram is carried on eight precision ball bearings with provision for take-up in case of wear.

SIX SPLINE SPINDLE—carried on four precision ball bearings. Drive pulley straddle-mounted to eliminate strain on spindle.

DRILL PRESS HEAD—cast in one piece, precision bored to fit machined column.

RUN-OUT ACCURACY—Guaranteed well within all commercial and industrial tolerances. Actually more accurate than many machines costing two or three times as much.

CAPACITY—RANGE is illustrated by the drawing above. Note that this machine will drill to the center of a 62" circle. Distances not illustrated are: Maximum distance nose of chuck to table: 13½"—Vertical traverse of spindle: 3¾"—Column diameter: 3¾".

N. B.—The new Walker-Turner Radial Drill when locked in drilling position is extremely rigid and has a minimum deflection. The drill may be tilted to 45° either right or left with relation to the table.

$325
(Including Motor)
Steel Stand $25. extra
F. O. B. Plainfield, N.J.

for DRILLING · TAPPING · LIGHT PROFILING

No longer need you pay two to three thousand dollars for a radial drill to perform light duty operations. **For less than one-fourth** of former costs, the new Walker-Turner Radial Drill will perform drilling, tapping, routing, light profiling and other such operations with speed and accuracy. The new Walker-Turner Radial Drill is more versatile than other drills because **the head can be tilted up to 45°** either right or left.

This new radial drill is priced at **only $325.**, F.O.B., Plainfield, N. J. This exceptionally low price is made possible by the combination of standard parts of two other service-tested Walker-Turner machines. It combines the base, column and sliding ram of the Walker-Turner Radial Saw with the head of the Walker-Turner Drill Press—over 50,000 of which are now in service in all types of industries. Check the specifications and performance ability of this new Radial Drill against your production problems. Write today for further information to Walker-Turner Co., Inc., 4311 Berckman Street, Plainfield, N. J.

walker-Turner
COMPANY, INC.
PLAINFIELD, N.J.

WALKER-TURNER MACHINE TOOLS

FOR METAL, WOOD AND PLASTICS

Publications

Write direct to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices

---

Plastics in the School and Home Workshop—2nd Edition

by A. J. Lockrey
D. Van Nostrand Co., Inc., 250 4th Ave., New York, 1940
Price $2.50 **233 pages, 182 illustrations**

The author has imparted a contagious enthusiasm for doing handcraft work with plastics to the pages of this book. To read it is to want to do it. Simple, yet complete, directions are given for fashioning 62 articles from cast phenolics, cellulose acetate, and methyl methacrylate resins. These projects cover a sufficient range of complexity to be suited for individual or class requirements, for beginners or amateur craftsman of advanced standing.

Various items about which readers of the first edition wrote in for further information have been expanded in this new edition. Many more project-designs of the types that proved most popular have been worked out and included. Chapters on acrylic resins, acetates, and slush molding have been added. The list of retail sources of supply of the plastics and the necessary accessories includes distributors in many localities. G. M. K.

Collected Papers of Wallace Hume Carothers on High Polymeric Substances

Edited by H. Mark and G. S. Whitby
Interscience Publishers, Inc., 215 4th Ave., New York, 1940
Price $8.50 **459 pages**

This is the first of a series of volumes to consider fully and critically the subject of high polymers. No investigator has excelled Carothers in advancing our knowledge of high polymeric chemistry and at the same time providing a basis for the development of technically useful synthetic polymeric materials, notably nylon and neoprene. The editors elected to collect and publish his "classical" papers as a fitting start to this set of books on high polymeric chemistry.

Carothers' work on polymerization and polymers divides itself into two distinct series of studies devoted to (1) "Studies on Polymerization and Ring Formation," and (2) "Acetylene Polymers and Their Derivatives." The papers in the first group are reprinted in Part 1 of this volume; those in the second group make up Part 2. A few other papers, mostly concerned with general discussions of the subject of polymerization, are reprinted in Part 3. Those responsible for the publication are to be congratulated for presenting it in a format in keeping with the high caliber of its contents. No student in this field of chemistry should fail to study Carothers' contributions to it. G. M. K.

Practical Latex Work

by H. J. Stern
India Rubber World, 420 Lexington Ave., New York, 1940
Price $1.50 **103 pages**

Rubber latex now accounts for about four percent of the total world consumption of rubber. Standard practice and current developments in the manufacture of latex goods by dipping, coating, and spreading processes are reviewed and discussed in this book. G. M. K.

Handbook for Chemical Patents

by Edward Thomas
Chemical Publishing Co., Inc., 148 Lafayette St., New York, 1940
Price $4.00 **270 pages**

The rules of the patent game as established by decisions of the Courts and by amendments to the Patent Statute are summarized. Citations are given to the author's lengthier treatise on this subject which covered the law up to the middle of 1937 and to the new cases which were decided in the following two and one-half years. Emphasis is on the proper procedure, form, and terminology to be used in preparing chemical patents in order to reduce the present likelihood of their becoming involved in litigation, which is now 3 to 4 times that of a mechanical patent. G. M. K.

● THE NATIONAL "INFORM-A-SHEET" PUBLISHED periodically by National Vulcanized Fibre Co., Wilmington, Del., is a four-page ready-reference bulletin which clearly explains and illustrates in pictorial and diagrammatic form the qualities, manufacture and applications of fiber and plastic laminate. The first eight issues, bound in looseleaf form, cover "How It Is Made, Workabilities, Uses in Many Industries, How Phenolite Is Made, How the Materials Are Machined, Peerless Insulation Material, Typical Phenolite Applications and National Engineering Service.

● HYDROGENATED COAL-TAR CHEMICALS ARE THE subject of a new brochure issued by the Barrett Co., 40 Rector St., New York. This 28-page plastic bound booklet furnishes information on these chemicals, their properties, used and appropriates testing methods. Illustrations of laboratory technique, graphs and diagrams add interest.

● PRACTICALLY THE ENTIRE OUTPUT OF THE NATION's vastly expanded machine tool industry is destined for the national defense program of the United States and the defense of England, with by far the major share going to United States aircraft builders and other manufacturers of national defense requirements, according to a survey published by the National Machine Tool Builders' Assn., Cleveland, O. The survey is based upon information as to plant expansion, employment, and engineering and development work undertaken on behalf of the national defense program, obtained from 115 companies representing approximately 80 percent of the total machine tool capacity of the country.

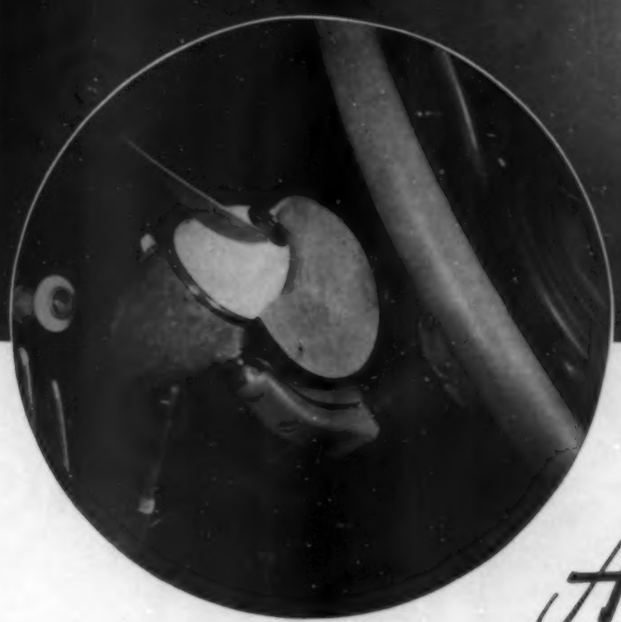
● EXACT WEIGHT SCALE CO., COLUMBUS, OHIO, HAS issued a profusely illustrated two-color folder showing modern industrial weighing in individual industries. The wide variety of specialized models and flexible weighing equipment is pictured and described.

● A 16-PAGE ILLUSTRATED BOOKLET BY AMPCO Metal, Inc., 3830 W. Burnham St., Milwaukee, Wis., describes and illustrates by photomicrographs the six grades and modifications of this copper, aluminum irony alloy used for many industrial applications.

● PENNSYLVANIA FLEXIBLE METAL TUBING CO., 72nd St. & Powers Lane, Philadelphia, has issued two descriptive pamphlets picturing and listing the specifications and uses of Penflex galvanized steel hose and couplings and Penflex bronze steam hose and clincher couplings.

● GENERAL ELECTRIC CO., SCHENECTADY, N. Y., has issued three new bulletins on its magnetic motor starter (2964B) and heavy duty DC motors (1542D and 1868B).

DURITE
Clears the Air!



ALMOST everything but the rubber blades on this fan* is made of sleek tan and brown Durite. As the fan keeps the windshield clean of moisture and circulates fresh air through the interior of the car, the streamlined Durite housing withstands the twin strains of heat and electricity without faltering. The finish is integral with the article itself, will never peel, chip, dent or fade.

This is another of the many applications of beautiful, strong Durite—the only phenol-furfural plastic.

DURITE PLASTICS* *Molded by: The General Industries Co., Elyria, Ohio*

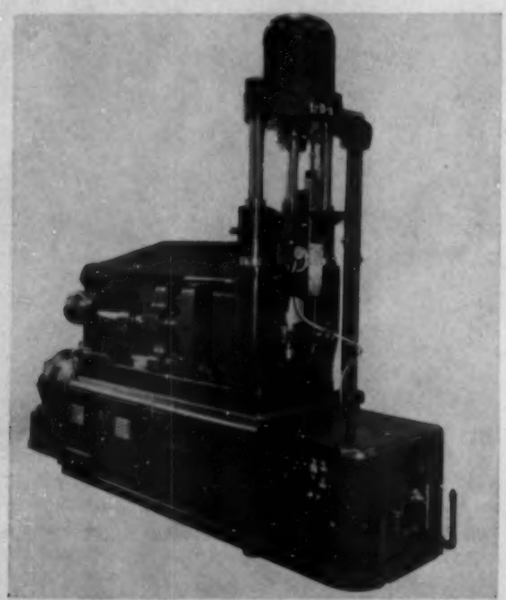
REG. U. S. PAT. OFF.

FRANKFORD STATION, P. O., PHILADELPHIA, PA.

Machinery and Equipment

● A MODERN HAND-OPERATED FLEXIBLE PRESS claimed to be adaptable for shearing in of punches or dies, small run blanking and forming jobs, also for laboratory and experimental work on plastics, has been developed by Pacific Hydraulic Press and Tool Co. Standard equipment includes a set of stop collars for setting the length of stroke and the hydraulic unit is said to be leak-proof and to automatically cut out when reaching maximum tonnage to prevent overloading. At present, it is built in two sizes, 12 in. by 18 in. with 15-ton capacity and 18 in. by 24 in. with 20-ton capacity, we are informed.

● A COLLOID MILL WITH TRIPLE PROCESSING ACtion, introduced by the C. O. Bartlett & Snow Co., is said to meet requirements for high rotor speed, easy feed and discharge of the material, easy dis-assembly for cleaning and easy re-assembly, absence of packing and glands promoting extreme cleanliness, and low motor horsepower per gallon of material processed. The machine is of the vertical type and is available in four sizes with 4 in., 6 in., 9 in. and 12 in. diameter rotors.

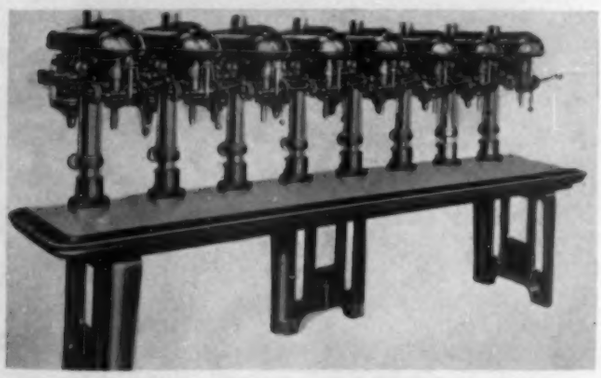


● LESTER ENGINEERING CO. HAS DESIGNED A NEW 8-oz. vertical injection molding machine (pictured above) with a pressure of 50,000 lb. per sq. in. Specifications are reported as follows: Size of die plates are 25 by 30 in.; mold opens $10^1/_4$ in. Maximum die space, $18^1/_2$ in.; minimum die space, 10 in.; mold closing pressure, 600 tons; maximum casting area, 150 sq. in. Diameter oil plunger cylinder, $13^1/_4$ in. Stroke of injection plunger, $12^1/_2$ in. Cylinders of 10 oz. and 12 oz. capacity are available and interchangeable on the machine, we are told.

● PHOTOSWITCH ELECTRONIC LEVEL CONTROL Type P30 now makes available to industry a simple electronic relay for level control of both conductive and non-conductive fluids and powders. It is reported that equipment is available to meet many specifications including single level control, on and off control at two levels, boiler feedwater control, and tank condensate signals. Installation merely entails attaching a probe fitting to the surface of the tank.

● SPEED CASE, A PRODUCT OF W. J. HOLLIDAY AND Co., is a recently developed low-carbon open hearth steel plate that is said to machine without tearing and is usually machined without resorting to the use of cutting oils. The machined surface is frequently so smooth that grinding or polishing is unnecessary. Because of its free machining qualities, tool life is greatly extended, regrinding being kept to a minimum, it is claimed. It can be machined at speeds up to 150–250 s.f.p.m. The material is said to be ductile, resistant to impact and abrasion because of the manganese throughout the matrix of this steel, and it has high shear and compression values and excellent physical properties with a tensile strength of 62,000 to 72,000 per sq. inch. Hot-rolled steel plate 4 in. thick shows a Brinell hardness of from 141 to 156.

● DURAKOOL, INC., ANNOUNCES TWO NEW MERcury switches with smaller overall mechanical dimensions. Both switches have new and novel internal construction characteristics that enable them to carry substantially great currents.



● DELTA MFG. CO. IS PRODUCING A SECTIONAL drill press which permits any user to make up his own drill presses to fit his exact needs—from a single spindle to a drill press a block long! By using these new sectional drill press production tables, it is said to be possible to build up drill presses with anywhere from one to an indefinite number of spindles—all 14 in. or all 17 in. or any combination of both—with the drilling heads spaced to fit the user's individual requirements.

Each table section measures $22^3/_8$ in. deep by 30 in. wide (with ends, 35 in. wide), with room for two spindles providing a minimum distance of 15 in. from center to center between spindles. They are claimed to be accurately ground and fitted, heavy, rugged and accurate. (Shown above) (*Please turn to page 100*)

PRACTICAL TRAINING IN FABRICATION *at Plastics ITI*

Students at Plastics ITI learn both the theory and commercial practice of plastics fabrication. They learn the selection and testing of plastics material for industrial and commercial uses, and the practical fabrication of these materials into finished forms. Training includes many hours in the Institute shops and laboratories, working with the same types of equipment used in production plants. Every opportunity is given students to develop their creative ability – to apply under actual shop conditions the knowledge of plastics fabrication gained in Institute classrooms.

All courses at Plastics ITI give the same thorough knowledge of plastics and their industrial and commercial applications. Included in the comprehensive training program are the history of materials, types and characteristics, physical, electrical and chemical properties, mold design, molding, laminating, fabricating, architectural and decorative designing (as applied to plastics), marketing and sales, and methods of testing and research. This training, although broad in scope, permits concentrated study in one or more particular divisions of the industry.

One Year Engineering, Short-term Day or Evening Courses, and Home Study (with or without shop training), are available. Write for illustrated literature.

Francis A. Gudger
President

John Delmonte
Technical Director

Plastics
INDUSTRIES TECHNICAL INSTITUTE
186 SOUTH ALVARADO STREET · · · LOS ANGELES, CALIF

ADVISORY BOARD

Donald Dew *Diemolding Corp.*
Dr. Gordon M. Kline *Nat'l Bureau of Standards*
Spencer E. Palmer *Tennessee Eastman Corp.*
Louis M. Rossi *Bakelite Corp.*
E. F. Lougee *Chairman*

In The Limelight

● THE PLASTICS INDUSTRY IS PARTICIPATING IN the rearmament program to an important extent. The following contracts were awarded to companies identified with the industry during 1940, between July 16th and September 30th. They do not include orders which may have been placed with the arsenals.

Kilgore Mfg. Co., Tippecanoe City, Ohio: (a) $163,200.00, (b) $112,100.00.

Mack Molding Co., Wayne, N. J.: $121,371.50.

Scripto Mfg. Co., Atlanta, Ga.: $1,094,000.00.

Contracts have also been awarded for the construction of gas mask lens molds and the molding of lenses. Reports are current on numerous developments which are under way on the use of plastics in various ordnance applications. The extensive application of methyl methacrylate and cellulose transparent sheets in military aircraft is expanding.

● BAKELITE CORP., UNIT OF UNION CARBIDE AND Carbon Corp., announces the appointment of Howard Smith as Manager of Varnish-Resin Sales with offices at New York City. Mr. Smith has been with the company since March 1925 and has always been closely associated with sales and service of varnish resins to the paint and varnish manufacturing industry. He has been in charge of the Cleveland sales office since 1932.

● A NEW METHOD FOR PLASTICIZING WOOD IS announced by the Forest Products Laboratory of the U. S. Forest Service at Madison, Wis. Comparatively simple in operation, reasonably inexpensive, and of apparent application in the bending of wood and in the production of cheap plastics and molded articles, the new treatment is a by-product of the Laboratory's research on the chemical seasoning of refractory woods.

During the course of seasoning experiments it was found that oak which had been soaked in a concentrated solution of urea and then dried became plastic and capable of being bent, twisted, and compressed when a temperature approximately 212 deg. F. was reached and while the wood was still in the dry condition. The wood retained its plasticity while at or above the critical temperature and resumed its normal hardness and rigidity when cooled, retaining its altered shape unless reheated. In addition it was found that urea-impregnated wood chips or sawdust when subjected to elevated temperatures and pressures could be compressed to a density approaching that of basic wood fiber, and that in becoming self bonding with the urea-lignin produced by the treatment, they form a material of thermoplastic properties.

So far there are no specific applications and available research effort is concentrated on exploring fundamentals of the treatment. Patents covering the new plasticizing process have been applied for by the laboratory.

● CONSTRUCTION OF A NEW, MODERN PLANT FOR the manufacture of its synthetic petroleum-derived rubber, Chemigum, is announced by The Goodyear Tire & Rubber Co.; and production will begin, in anticipation of defense needs, as soon as equipment can be installed, probably within six months.

● METAPLAST CORP., NEW YORK, REPORTS THE REmoval of its plant to 205–209 West 19th St., on January 1, 1941. Located at the same address is the Metalitor Corp., a Metaplast licensee specializing in the plating of plastics.

● STANDARD NOTELTY BOX CO., 385 GIRARD AVE., New York, we are informed, is equipped for injection molding.

● A SERIES OF MEETINGS SPONSORED BY THE SUBdivision on Rubber and Plastics at the annual meeting of the A.S.M.E. were held at Hotel Astor, during the week of December 2. The papers presented at the Rubber and Plastics meetings, included "Design and Application of Phenolic Resin Asbestos Compositions in Corrosion Resistant Equipment," by W. H. Adams, Haveg Corp., Newark, Del. (See Dec. 1940 MODERN PLASTICS, page 53); "Rubber Springs—Compression Loading," by J. F. Downie Smith, Research Division, United Shoe Machinery Corp., Beverly, Mass.; "The Creep of Natural and Synthetic Rubber Compounds in Shear," by Ivan Gazdik and S. H. Hahn, B. F. Goodrich Co., Akron, O.; "Notes on the Creep of Neoprene in Shear," by F. L. Yerzley, Rubber Chemicals Div., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

● AN ANNOUNCEMENT OF A $300,000 EXPANSION OF the General Electric Co.'s Plastics Department, Pittsfield, Mass., has been made by G. H. Shill, manager. Accelerated by the needs of national defense, the new capacity will no doubt be ready to absorb the increasing demands for plastics products when the war emergency passes.

● A NEW DEVELOPMENT IN HIGH IMPACT PHENOLIC molding compounds, Durez 1910, has recently been completed by Durez Plastics & Chemicals, Inc., of North Tonawanda, N. Y. The material contains graphite and was developed especially for such applications as bumper shoes, refrigerator lock bolts and other parts where minimum frictional resistance is desirable. It has a particle size comparable to dry rice and is said to preform easily and flow freely through standard feeders.

● VOGES MFG. CO., INC., 99TH ST. & 103RD AVE., OZONE Park, N. Y., reports it is now equipped to do injection molding.

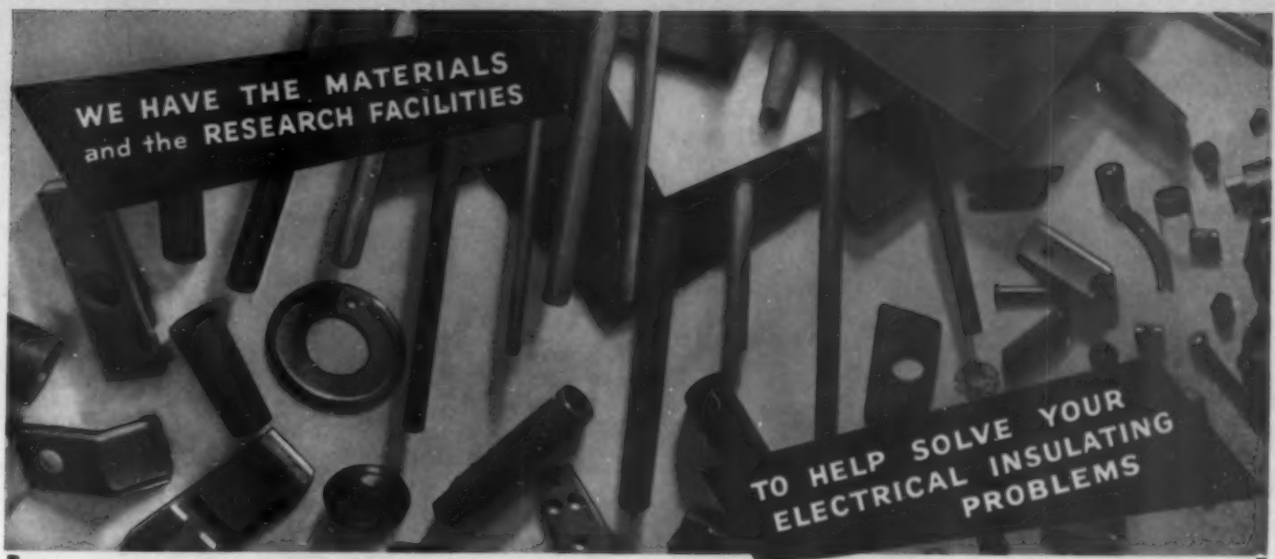
● ANNOUNCEMENT HAS JUST BEEN MADE THAT C. N. Cahill, formerly general manager and sales director of Autopoint Co., subsidiary of Bakelite Corp., and formerly president of the Chicago Venetian Blind Co., has been made vice president and director of sales of the Gits Molding Corp., Chicago.

● NEWLY FORMED TO SERVE THE SOUTHEASTERN section, the Southern Plastics, Co., Columbia, South Carolina reports it will be prepared to do injection molding and continuous length extrusion. J. W. Lindau is director and Irwin Kahn, recording secretary.

● AMERICAN SCREW CO., LICENSOR, OF PROVIdence, R. I., announces that the number of firms manufacturing Phillips recessed head screws has reached 18. The list of licensees follows: Central Screw Co., Chandler Products Corp., Continental Screw Co., Corbin Screw Corp., International Screw Co., Lamson & Sessions Co., National Screw & Mfg. Co., New England Screw Co., Charles Parker Co., Parker-Kalon Corp., Pawtucket Screw Co., Pheoll Manufacturing Co., Russell, Burdsall & Ward Bolt & Nut Co., Scovill Mfg. Co., Shakeproof Lock Washer Co., Southington Hardware Co., Whitney Screw Corp. Descriptive literature may be obtained from the licensors.

● ABOUT 300 PEOPLE INCLUDING MEMBERS AND guests attended the regular meeting of the New York section of the American Chemical Society at the Hotel Pennsylvania, December 6th. Papers presented were: "Recent Developments in the Nitroparaffins," by H. B. Hass, Head, Dept. of Chemistry, Purdue University; "Plastics in Wearing Apparel," by Howard S. Bunn, Mgr., Plastics Div., Carbide & Carbon Chemicals Corp.; "Cellulose Plastics in Wearing Apparel," by James F. Walsh, Research Consultant, Celanese Corp. of America; "Cast Phenolic Resins," by Wesley R. Thompson, Technical Director Catalin Corporation.

(*Please turn to next page*)



TO every manufacturer facing a new manufacturing problem, or an unsolved old one, the C-D Laboratory's years of experience in solving difficult electrical insulating problems is immediately available. Here is a research department you can treat as your own. Here are a group of men who for many years have been building records of material performance that today will prove invaluable in assisting you to find the appropriate insulating material for your problem.

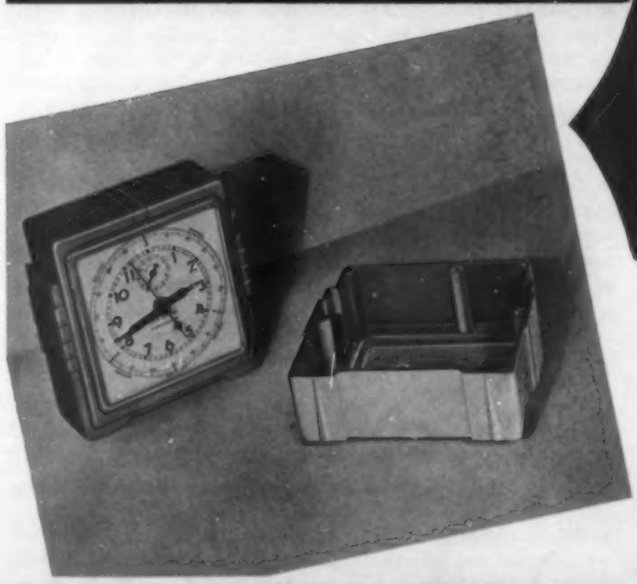
Without obligation, and in strict confidence you can talk to our technical research men about your insulating problem. Whether it be mechanical, electrical or thermal, you can be sure our recommendations will be unbiased because we manufacture all types of laminated and molded plastics as well as Micabond. Any of our sales offices, located in all principal cities, will promptly forward your request for technical help.

CONTINENTAL-DIAMOND FIBRE CO.

NEWARK - - - - - - DELAWARE

Take time to look into Plastics

DESIGNED and MOLDED by *Stokes*



There's a world of difference between a customer bragging, "Look what I bought" and apologizing, "Look what they sold me." Nine-tenths of that difference usually lies in the design of the article.

If you want to lift your product out of the commonplace and yet want to maintain a profitable margin, bring your problem to STOKES Design-Engineers. We offer you specialized service, in designing plastics that reduces sales effort and stimulates buying, with designs appealing to the eye and adaptable to low cost production.

JOSEPH STOKES RUBBER CO.

Gen'l Offices: 322 WEBSTER ST., TRENTON, N. J. . . . . Plants: TRENTON, N. J. and WELLAND, ONT.

MOLDERS OF ALL PLASTICS—Including Hard Rubber—SINCE 1897

● MANUFACTURERS OF FABRICATED PLASTIC PRODucts, not elsewhere classified, reported slight increases in employment and wages and a moderate increase in production for 1939 as compared with 1937, according to preliminary figures compiled from returns of the Census of Manufactures for 1939 and released by Director William Lane Austin, Bureau of the Census, Department of Commerce.

This industry, as constituted for census purposes, embraces establishments primarily engaged in the manufacture of finished products (not elsewhere classified) made of synthetic resins, cellulose compounds and casein or galalith.

The 1939 Census of Manufactures is the first census for which employees who were primarily engaged in distribution, construction, etc., activities have been called for separately on the schedules. It is not known how many of the wage earners reported for 1937 were engaged in distribution and construction and how many were engaged in manufacturing. Employees of the plants reported as engaged in distribution and construction activities in 1939 are not included in this preliminary report but will be included in the final report.

The wage earners primarily engaged in manufacturing in this industry in 1939 were 15,094, an increase of 6.4 percent compared with 14,184 reported for 1937, and their wages, $17,688,104, exceeded the 1937 figure, $16,955,194, by 4.3 percent.

The value of products of the industry for 1939 amounted to $71,904,067, an increase of 15.7 percent compared with $62,139,479 reported for 1937.

Summary statistics for the industry for 1939 and 1937 are given in the following table. Detailed statistics on production will be given in a later report. All figures for 1939 are preliminary and subject to revision.

SUMMARY FOR THE INDUSTRY: 1939 AND 1937

(Because they account for a negligible portion of the national output, plants with annual production valued at less than $5000 have been excluded since 1919.)

	1939	1937	Percent of Increase
Number of establishments	216	129	67.4
Salaried personnel[1]	2,081	1,812	14.8
Salaries[1,2]	$ 4,936,817	$ 4,205,542	17.4
Wage earners (average for the year)[3]	15,094	14,184	6.4
Wages[2,3]	$17,688,104	$16,955,194	4.3
Cost of materials, supplies, fuel, purchased electric energy, and contract work[3]	$31,747,085	$26,639,637	19.2
Value of products[3]	$71,904,067	$62,139,479	15.7
Value added by manufacture[4]	$40,156,982	$35,499,842	13.1

[1] No data for employees of central administrative offices are included.

[2] Profits or losses cannot be calculated from the census figures because no data are collected for certain expense items, such as interest, rent, depreciation, taxes, insurance, and advertising.

[3] The item for wage earners is an average of the numbers reported for the several months of the year and includes both full-time and part-time workers. The quotient obtained by dividing the amount of wages by the average number of wage earners should not, therefore, be accepted as representing the average wage received by full-time wage earners.

[4] Value of products less cost of materials, supplies, fuel, purchased electric energy, and contract work.

● ALL-AMERICAN AIRCRAFT PRODUCTS, INC., 2837 Long Beach Blvd., Long Beach, Cal., reports it is now equipped to handle compression molding and plastic sheet forming work.

● CHRISTMAS CAME TO ROCKEFELLER CENTER WITH all the pomp and splendor that is attached to the season. Decorating the 88-ft. Norway spruce tree that towers 9 stories above the street in front of the RCA Building are 800 plastic globes made of Monsanto's Fibestos (shown above). These globes are fabricated of sheets 0.060 gage and drawn to form hemispheres. When the halves are cemented together each globe measures 18 inches in diameter. Luminous white in the daytime, as dusk approaches the balls change to pastel shades of red, blue, green and gold. They are lighted by colored bulbs within.

● PLASTIC PLANE FUSELAGES, MADE UNDER THE Vidal process have been ordered by the Canadian Government for experimental purposes according to a recent report in the New York *Times*. (The manufacture of these plastic plywood planes has been described previously in MODERN PLASTICS July 1940 issue, page 25.)

● THE ANNUAL EXPOSITION OF THE COIN MACHINE Industries, Inc., held Jan. 13 to 16 in the Hotel Sherman, Chicago, reflected the important consideration given plastics in the manufacture of coin-operated equipment. A great percentage of all the machines shown in the exposition, however, according to Harvey Carr, editor of the Coin Machine Journal, Chicago, emphasized plastic values, including many types of entertainment, vending and music equipment.

He asserted that plastics have been welcomed particularly because they have enhanced the decorative possibilities, have given greater play for styling and improvement in mechanical operation, and have increased the utility of the other materials.

One indication of the advancement made in direct utilization has been the introduction of translucent plastics for direct lighting in coin-operated pinball games. Previously, light was provided by reflection but with the application of plastics with their obvious advantages lights have entered the field of play itself. Even switches and other small parts of many coin-operated machines are of plastic content. But, as Carr sees it, the field is still wide open as far as further developments in plastic utilization in coin machine manufacture are concerned.

● J. K. TANAKA AND ASSOCIATES REPORT THEY have opened a new office for industrial designing in the Paul Brown Bldg., St. Louis, Mo. (*Please turn to next page*)

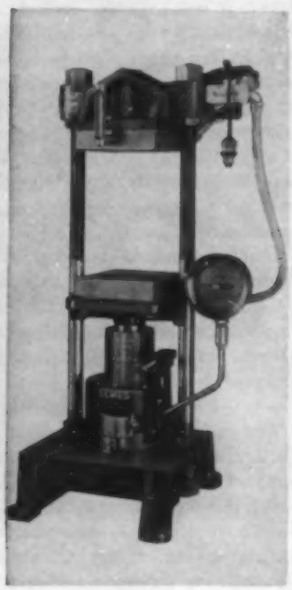
Plan Production Profits *with an* ELMES HYDRAULIC LABORATORY PRESS

ADVANTAGES

1 Adapted to test and experimental runs as well as small batch production. Can be used for a great variety of applications.

2 Entirely self-contained.

3 Maintains constant pressure against a dead head for long periods of time by means of improved new valve with special packing.



Trustworthy performance details for production guidance are easily and economically obtained on a small scale with this Elmes Hydraulic Laboratory Press.

The unit is saving time and needless repetition of tests in many leading laboratories where it has proved to give reliable results and ease of operation, in accordance with the high standards set by Elmes Presses of larger capacity.

Find out from Elmes how this versatile Laboratory Press can contribute to your experimental and production progress—at small cost. Facts and figures are yours for the asking, without obligation.

Also Manufactured in Canada
Williams & Wilson, Ltd., Distributors

CHARLES F. ELMES ENGINEERING WORKS
225 N. MORGAN ST. Chicago SINCE 1851

Clover Products

MUST EARN THE RIGHT

to this mark of CLOVER QUALITY

Under the critical eyes of Clover engineers and chemists, the manufacture of Clover Coated Abrasives is a routine of rigid control. Nothing is left to chance. And before the finished product can leave the Clover Plant, it must prove by actual performance tests that it can do the work for which it is recommended. Only in that way can it earn the right to carry the *Mark of Clover Quality.*

COATED ABRASIVES AT THE RIGHT PRICES FOR YOUR EVERY SANDING NEED

If your distributor cannot supply you, write us direct. Also ask us for informative Abrasive Manual, and for free working sample offer. Address DEPT. M.

CLOVER MFG. CO., NORWALK, CONNECTICUT

WANT BETTER GRINDING AND LAPPING COMPOUND? DEMAND CLOVER—FAMOUS FOR 38 YEARS

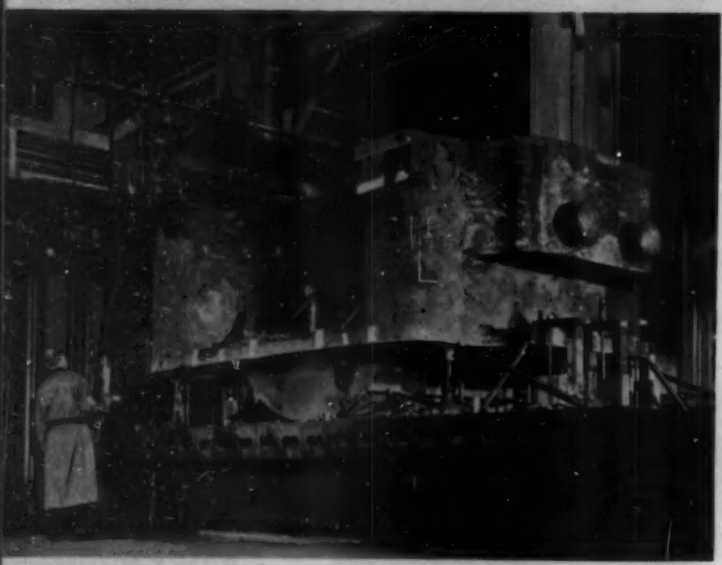
Supplied in eight grades, there is a Clover Compound for your every need. Look for the famous green can.

CLOVER
Coated Abrasives
Easily Identified by Color-Striping and the Famous Clover Trade Mark

QUALITY ABRASIVES SINCE 1903

1

2



3

● WITH ITS MODERN NEW PLANT AT MOUNT Gilead, Ohio, now in full operation, Hydraulic Press Mfg. Co. reports it has increased its manufacturing capacity by 100 percent in timely anticipation of immediate national defense needs. Straight-line production is applied in the building of H-P-M Fastraverse presses for aircraft, automotive, general metal-working and process industries in the new manufacturing area, where modern materials and building equipment have been combined in a strictly functional plant. While total floor space has only been increased by about one-third, the elimination of backtracking and the availability of new machine tools and modern handling equipment will enable the company to triple the production of its standard line of plastic injection molding presses and Hydro-Power pumps, controls and power units at plant No. 1.

General headquarters of the company have been transferred to a new office building adjoining the new plant which dominates a 60-acre site. Available office space at the old plant will be occupied by the production and engineering staffs of Hydro-Power Systems, Inc., which are being increased.

The new plant (Fig. 1) was designed and built by The Austin Co. and is of welded steel frame construction. Except for the compact single-story office building and the main (south) plant facade directly behind it, where buff face brick has been used, the walls consist entirely of continuous projected steel sash in high runs, separated only by narrow bands of 4 in. corrugated asbestos. The sash and asbestos siding on the north, west and east sides of the building are merely bolted to the frame and will facilitate expansion of the plant in any of these directions without loss of materials. Hammered glass has been used throughout sash on the south and west to neutralize the effect of direct sunlight. Clear glass is used on the north and hammered glass on the east. The roof is an 18-gauge steel deck which was spot-welded and has one inch cork insulation, topped by built-up roofing. Lighting for night work is provided by incandescent and mercury lamps.

The building is 400 ft. long and has three bays. The high (north) bay, 55 ft. wide, has a 36 ft. working clearance below the hooks of two 50-ton cranes which serve this area. The intermediate bay is 40 ft. wide and affords 22 ft. working clearance below the hooks of two 15-ton cranes serving this section of the plant. All major operations in the machining and assembly of press parts take place in these bays, while the low bay, 30 ft. wide, on the south, houses secondary equipment, tool cribs, light material storage, factory offices and lavatories. In designing the structural steel, provision was made for the addition of a second 40 ft. bay with craneways on the north side of the high aisle.

With production flowing from west to east, and one railroad track entering the plant at the west for delivery of large castings and other equipment, assembly and shipping are concentrated at the east end. The floor at this end is 4 ft. lower than in the main production area (Fig. 5). This makes it possible to bring railroad cars for outgoing shipments in on the lower level, so that presses can be loaded directly from the main production floor and provides extra head room throughout an area of about 5000 sq. ft. for assembly of presses of exceptional size. Two pits are also provided on the lower level so that die cushions, normally located below the floor in actual practice, can be assembled in presses. Heavy concrete floors have been provided throughout the plant,

(*Please turn to next page*)

1—Simple functional lines characterize the structure of the new Hydraulic Press Mfg. Co. providing 60,000 sq. ft. of manufacturing space. 2—Rough castings up to 60 and 70 tons are finished on planers, boring mills, etc., at this end of the high craneway aisle. Assembly, testing and shipping are at the far end of the plant. 3—Huge 142,000 lb. casting machined on a double-side planer, is for a 5000-ton press

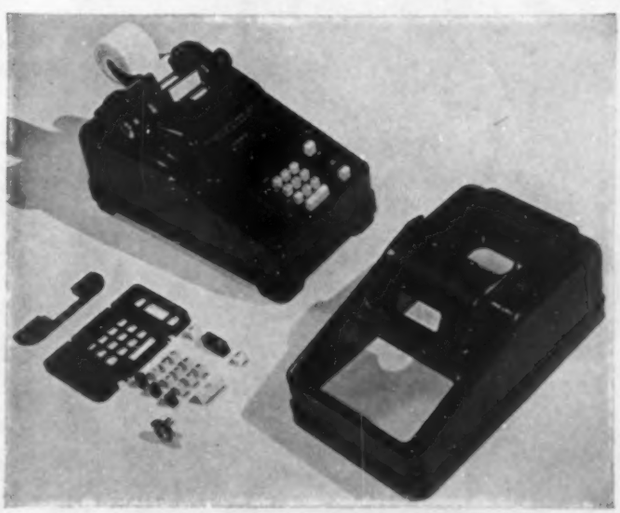
The right answer **ALWAYS**

Adding machines don't make mistakes. Nor can any "mistakes" be tolerated in their construction. It's a precision job all the way through.

That's one reason the Sundstrand Division of Underwood Elliott Fisher, when a molded plastic design was decided upon for their adding machine, picked Auburn to mold the case, key plate and keys.

Whatever your product, if it's of molded plastics, you can be sure of the right answer to your molding problem, when you turn the whole job over to Auburn.

Sixty-five years experience in the handling of molded plastics and in solving molding problems adds up in your favor when the utmost in precision and quality are required without a premium in price.

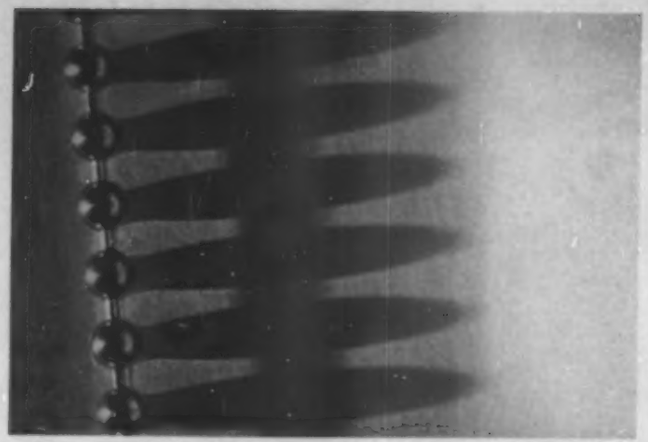


MOLDED PLASTICS DIVISION

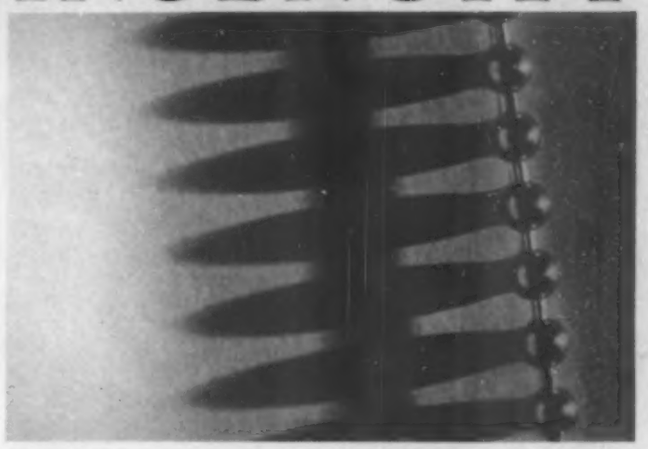
AUBURN BUTTON WORKS, Inc.

1876–1941

AUBURN, N. Y., NEW YORK, CHICAGO DETROIT, SYRACUSE, CLEVELAND, BOSTON



INGENUITY



BEAD CHAIN*

In adapting BEAD CHAIN* to practical uses with products in many fields during the last twenty-five years, we have developed numerous ingenious assemblies that have added to the efficiency and sales appeal of the products. Perhaps you, too, may have a product problem that can be solved with non-kinkable BEAD CHAIN* when our ingenuity and yours is applied to its solution.

BEAD CHAIN* is available in bead diameter sizes from 3/32" to 3/8". It is made in various metals, including Monel, and finished to harmonize with your product.

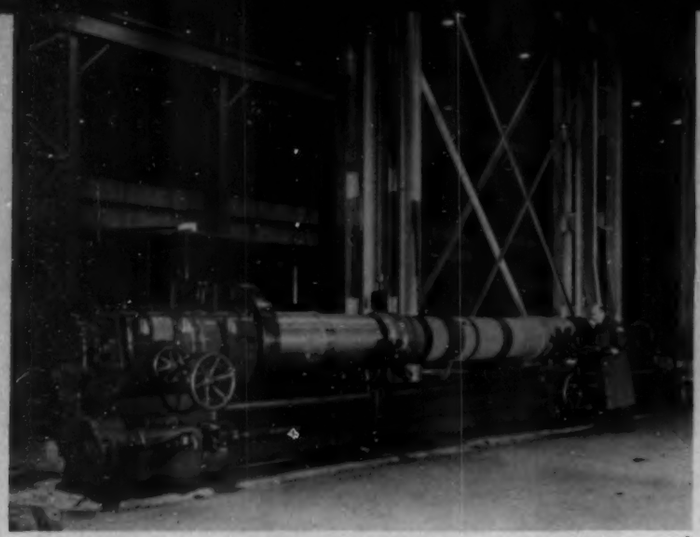
BEAD CHAIN

ESTABLISHED 1914

Trade Mark Reg. U.S. Pat. Off.

THE BEAD CHAIN MANUFACTURING CO.

*Reg. U. S. Pat. Off. 60 MT. GROVE ST., BRIDGEPORT, CONN.



4

5

4—Tremendous tie-rod being turned on the lathe above is 280 in. long, 22 in. in diameter and weighs 28,000 lbs. **5**—*Presses of exceptional height are assembled in this depressed area at the east end of the integrated plant. Others of more normal size can be seen in manufacture on the main working floor which is four feet higher—just beyond the siding and track scale which is recessed in the retaining wall*

with special sections of wood block inset to facilitate the handling of large castings and forgings.

In the production sequence, work travels from left to right—from receiving department to casting cleaning—from flatcar to cutting department in the case of steel sheet—from casting cleaning and steel cutting to layout department—from one machine after another to the assembly floor—from assembly to test, to flatcars again to be hauled to their destination to establish production records for their owners.

At the west end of the plant rough steel casting weighing as much as 175,000 lbs. are unloaded from railroad "flats" to the layout section with exceptional ease and speed. They are lifted onto the beds of huge planers or mills in the case of press cylinder castings, press bed castings, press platen castings, etc., or to long engine lathes, should the piece in question be a press tie-rod or press ram.

As oil is used as the pressure medium in all H-P-M presses, special provision has been made in the new plant for handling a large volume of oil required for testing by a unique distributing system. A system of pipe lines running to every building column provides a means for filling any press with oil by simply connecting an oil hose to the nearest oil outlet. After testing the oil is returned for re-use. Heating requirements of the plant are met by two stoker-fed low-pressure boilers of 200 hp. capacity which serve eight thermostatically controlled large low-pressure unit heaters that have been suspended from the crane rail between the high and intermediate aisles along the line of columns.

All heavy equipment including a precision boring mill, radial drills, spindle boring mill, planers, etc., have been transferred to the new plant in addition to new equipment installed.

Back in 1877 this company built its first hydraulic press—not for the metal-working industry—but for making cider. From this early beginning, under the leadership of the late Frank B. McMillin, the company paved the way for its early entree in the metal-working and chemical processing industries.

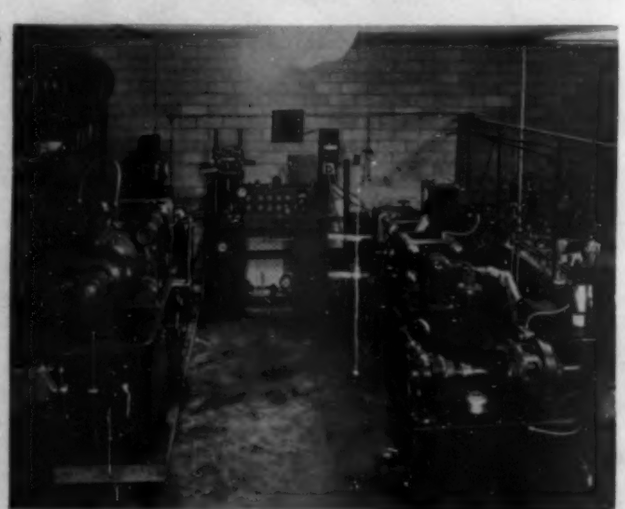
Under the guidance of Howard F. MacMillin, now president of the company, and Walter Ernst, chief engineer, numerous developments affecting hydraulic press operation were introduced and accepted by the trade. It was in 1927 the H-P-M Fastraverse system of operation featuring the self-contained method of press operation and control was introduced. Other company developments of the last few years are: heavy-duty radial type pressure generators; double-action presses for metal-working; triple-action presses for the deep drawing of sheet metal; a complete line of plastic injection molding presses; and a series of presses expressly for the aircraft industry.

Recently the company established a new plastic laboratory under the supervision of Warren R. Tucker, who for years has represented the company as a development and sales engineer. Installed in this new laboratory are two standard H-P-M plastic injection molding presses, a standard H-P-M laboratory press complete with attachments and also special laboratory equipment, consisting of an auxiliary circulating fluid heating system for heating plastics has been installed. This heating system is said to be unique because of its controls for obtaining the correct temperature required for testing the plasticity of certain plastics.

The H-P-M plastic molding laboratory according to the report was originated to assist the plastic molder in solving his difficult molding problems in an atmosphere of privacy and protection. Many molders desire the privilege of trying dies, receiving suggestions as to correct mold designs, and discussing important molding problems with the press builder direct. Molders, or prospective molders, are welcome to discuss their molding problems with the laboratory director personally and privately, the company informs us.

6—H-P-M's newly established testing laboratory is completely equipped with injection, compression and laboratory machines and other special experimental devices

6



Plastic Harmony

Only the perfect coordination of materials, engineering skill and modern equipment will produce faultless harmonies of beauty, accuracy and durability in plastic parts. Kurz-Kasch engineers who "know how" through years of experience backed by a large, well-equipped plant will bring harmony to your discordant plastic problems. Write to Kurz-Kasch for further facts.

The Hammond Instrument Company of Chicago, chose Kurz-Kasch to mold the keys, tone selectors and end plates for the keyboard of the popular Hammond SOLOVOX.

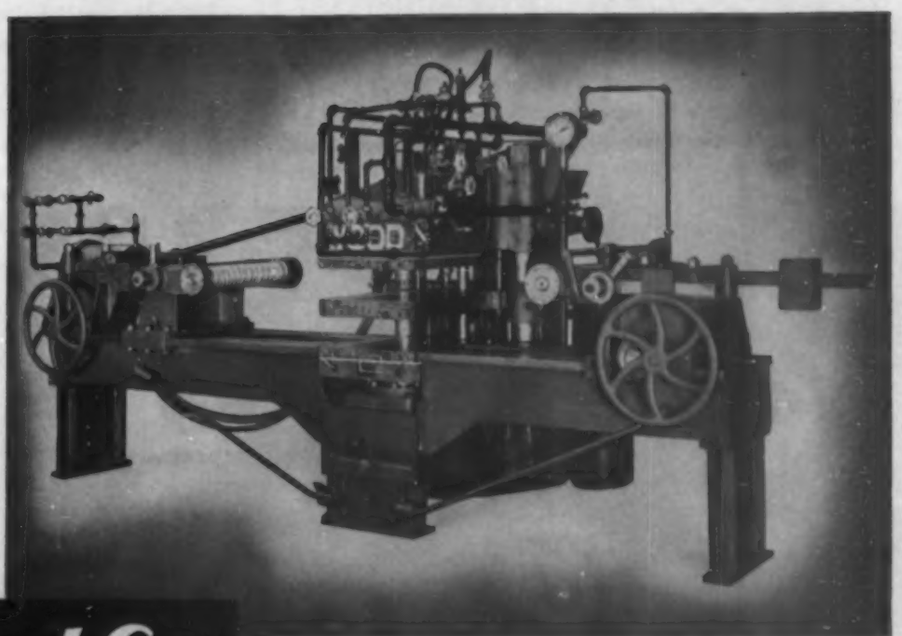
Kurz-Kasch, Inc. DAYTON, OHIO

Branch Sales Offices: New York, Chicago, Cleveland, Detroit, Los Angeles, Dallas, St. Louis, Toronto, Canada. Export Office: 116 Broad Street, New York, N. Y.

ONE OF THE LARGEST EXCLUSIVE MOLDING PLANTS IN AMERICA

FOR HYDRAULIC PRESSES . . . CONSULT R. D. WOOD

Somewhere within the broad range of Wood Presses there is likely to be a standard unit that will fully answer your particular needs. And if your press requirements are special, the design experience of Wood engineers is yours for the asking.



ESTABLISHED 1803

R.D. Wood Co.

PHILADELPHIA, PA.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE

This one of the many R. D. Wood Presses is an open-side precision V-Belt press with a hydraulic belt stretcher. Steam plates are 24" x 24" and the 9" main ram operates on 1500 lbs. working pressure.

Plastic-City, Washington, D. C.

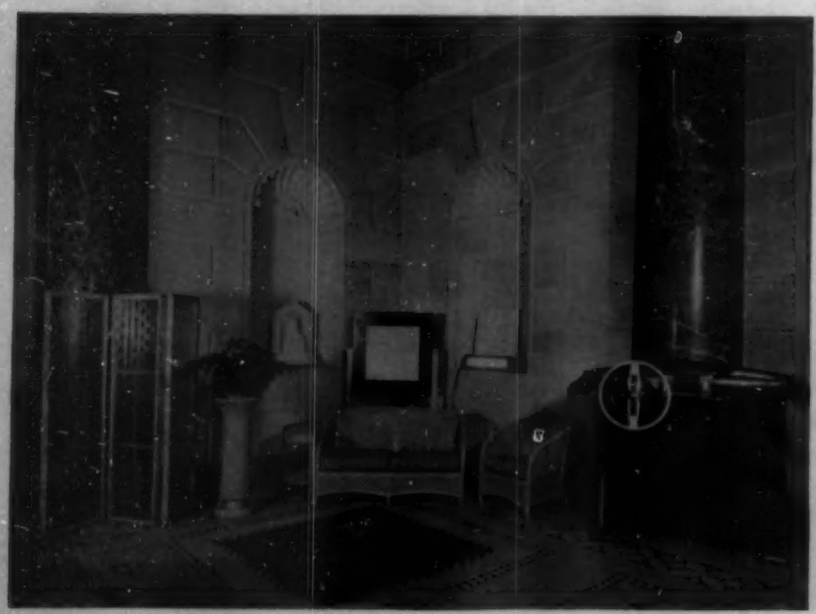
(*Continued from page 35*) the public how all of these new materials emerge from the chemists' test tubes into products that help to make our world a better and more comfortable place in which to live.

This exhibit is the forerunner of an extensive promotion program scheduled by MODERN PLASTICS for 1941. Plans call for an unending chain of elaborate and professionally staged displays to appear in leading department stores throughout the country. It is expected that a complete announcement of this program can be made in the February issue.

These exhibitions are but another example of the constructive and practical type of promotion in which MODERN PLASTICS is interested. They are designed to benefit the plastics industry as a whole and to provide the great American public with first-hand information about the important role that plastics are playing in their everyday lives.

Simultaneously with the Washington show, Boston's Institute of Modern Art featured an American Plastics Exhibit, also assembled in collaboration with MODERN PLASTICS magazine. Ranging in price and variety from 10-cent store items to an airplane instrument panel and a juke box worth $400.00, this display extended until January 12, after which it traveled to the Museum of Fine Arts in Springfield, Massachusetts, where it will be open to the public. James S. Plaut, director of the Boston Institute, praises the exhibition as the most elaborate display of its kind ever staged by an American museum.

Style and fashion applications of plastics are among the highlights of this exhibit.



LEAROK—The Clean Compound Without Free Grease for Cutting and Buffing

8 Grades for Cutting
11 Grades for Cut and Buff
7 Grades for Buffing

List of Plastics for which LEAROK has been tested and proved

PHENOL FORMALDEHYDE MOLDING

Bakelite, Catalin, Celeron, Durez, Durite, Heresite, Inclur, Insurok, Uniplast, Makalot, Neillite, Resinox, Textolite

PHENOL FORMALDEHYDE CAST

Bakelite, Catalin, Gemstone, Marblette, Monsanto CP

UREA FORMALDEHYDE MOLDING

Bakelite, Beetle, Plaskon

ACRYLATE & METHACRYLATE

Crystalite, Lucite, Plexiglas

STYRENE

Bakelite, Styron

HARD RUBBER

Ace, Luzerne, Rub-Tex

CASEIN

Ameroid, Gala, Galorn

ETHYLCELLULOSE

Ethocel

CELLULOSE ACETATE

Bakelite, Lumarith, Masuron, Monsanto CA, Tenite, Nixonite, Plastacele

CELLULOSE ACETATE BUTYRATE

Tenite II

CELLULOSE NITRATE (Pyroxylin)

Celluloid, Monsanto CN, Nixonoid, Pyralin, Soy Bean

The above information is indicative of the extensive research work we have carried on in the past few years in adapting this widely used compound—LEAROK—to plastics. We suggest that you send us samples of your work with an outline of what you wish to have done. Our technical men will recommend the grade of LEAROK which should reduce your costs of cutting and buffing.

THE LEA MFG. CO.

WATERBURY, CONN.

Specialists in the Production of Clean-Working Buffing and Polishing Compounds

SHAKEPROOF

Thread-Cutting Screws

Type 2 Double-Slot

Type 9 Multi-Flute

● Because they actually cut their own threads in any plastic material, either molded or laminated, these two screws can save you time and money. The extra cost of threaded inserts or separate tapping is eliminated and tighter, stronger fastenings are assured.

WRITE FOR SAMPLES!

Try these screws on your own product—see for yourself how they can help you save time and protect product performance. Stock samples of the type desired for testing purposes will be gladly forwarded on request.

SHAKEPROOF LOCK WASHER CO.

Distributor of Shakeproof Products Manufactured by
ILLINOIS TOOL WORKS
2531 North Keeler Avenue, Chicago, Illinois
Plants at Chicago and Elgin, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario
Copyright 1941 Illinois Tool Works

Plastic-Plywood

(*Continued from page 31*) hexagonally, is cut into quarters lengthwise. The quarters are then trimmed so that each veneer is cut approximately at right angles to the annular rings. This cutting produces stripes running the entire length of the veneer in most woods.

Back Culling: This is done in a rotary lathe with a metal stay log. After the log is cut through the center lengthwise, it is bolted to the stay log on the bark side. The rotary lathe cuts the veneer similarly to half-round except it starts through the heart first. It is very similar to flat sliced veneer in certain woods.

Sawing: This is the oldest form of veneer cutting. The log is not cooked but is mounted on a travelling carriage which trundles the log back and forth against the blade of a saw—the carriage moving forward after each operation the thickness of the veneer plus the thickness of the saw. Sawn veneers are extravagant in that at each cut of the saw, wood to the thickness of the saw kerf is wasted in sawdust. A slight variation in the position of the log produces rift sawn veneers, the cuts being made at a more or less acute angle with the annular rings. This sawing is generally confined to White Oak.

While the differences in figure between the various types of veneer cutting are basic, the wide variations in faces are obtained from different parts of the tree. The tree trunk itself, known as long wood, yields a variety of figures bearing more or less descriptive names. They are produced by the following methods:

In Rotary Cutting, Plain, Figured, Blistered, Quilted, Bird's Eye and Curly, figures are obtained.

In Flat Slicing, the Cross Fire and Swirls are produced.

In Quarter Slicing, Fiddle Back, Rope, Stripes, Cross Figure, Flake and Broken Stripe, large Mottled or Block Figure, small Mottle or Bee's-Wing Figure, Ribbon and Pencil Stripe are produced.

Identification of figures

Novelty veneers are cut from crotches, burls and stump wood. Crotches are that portion of a tree just below the junction point of two limbs. The grain of the wood is crushed and twisted in growth and produces a wide variety of figures such as Shell, Moon Figure and Feather or Plume and Flame Figure. Crotches are sliced parallel to their axis. The outer veneers show a swirl figure. As the veneer knife approaches the center of the log, the full crotch figure is developed. Crotch veneers are used upside down or in four-way matched faces.

Burls are warty excrescences which are infrequently encountered. They are caused by some type of injury to the tree affecting the layer of wood just under the bark, generally started by insects or bacteria. As these develop, they cause distortion in the wood fiber and result in tiny humps which, as the tree grows, further emphasize the irregularity of the grain. Burls are ordinarily cut half round to reveal their swirl knots or eyes.

Butts, or Stump wood, as its name implies, is produced from the stump of the tree. Here the weight of the tree and the development of individual roots produce a variation in grain including plain stump wood, oyster figure, highly figured veneers and heart and sap wood. Stump wood is generally cut half-round.

12—*These plastic-plywood forms were re-used as many as 15 times in laying the deck of the San Francisco to Oakland bridge crossing*

COURTESY, DUREZ PLASTICS & CHEMICALS, INC.

Veneer matching

Owing to the wide diversity of figure types and the fact that veneers from the same flitch are symmetrical, there is hardly any limitation to the variety of patterns which may be produced by the artistic designer. Through this matching are produced the exquisite fancy panels which grace architectural installations and are used in making fine furniture.

Book matching is basic. Veneers are placed in position as though they were the facing pages of a book. Butt matching, diamond, half-diamond, square, box, "V"-matching, checker board and herring bone, as their names describe, are resorted to for striking and artistic effects.

Core and cross-banding

Specifications for cores and cross-banding depend primarily on the use to which the finished panel is to be placed. Cores are ordinarily built up of narrow pieces of lumber bonded together and planed. Veneer construction, in which all plies of core and cross-banding are of approximately the same thickness, is specified where engineering requirements call for uniform strength in all directions along the face of the panel or where panels are constructed on sharp curves.

Plywood bonding agents

Adhesives are probably the most important individual factor in the production of plastic plywood. Almost any vagaries of grain in the veneers can be overcome if care is taken in the manufacture and the proper binding agent is used between the plies. Before the development of and widespread adoption of resinous bonding agents by the manufacturers of plywood they used cold glues of various bases including casein, blood albumin, starch and vegetable types. The advent in the indus-

MODERN METHODS OF MARKING

Get ALL eight marking advantages with MARKEM

No other method or process for marking plastic product, part or container for identification, appearance and instruction offers ALL these advantages. All eight are essential to better, faster and more economical production. With Markem Plastic Printers, none of these advantages is sacrificed.

Colors A wide variety of vivid or pastel colors, developed from our own time-tested formulas, are available. Model PLB (shown above), the latest Markem Plastic Printer, prints two colors in one operation and is an outstanding contribution to the plastics industry.

Legibility Accurate registration of colors, clear definition and new sharpness of detail compare favorably with the best printing standards.

Permanency Imprint adheres with highly tenacious grip. Integral imprint means nothing to fasten; nothing to become loose.

Simplicity Direct application eliminates all extra operations. No before or after preparations or treatment.

Speed No limit! Capacity dependent only upon method of feed, governed by size and shape of piece. New, quick setting, air drying chemical printing compounds permit pieces to be ready for packing in two or three minutes. No waiting upon outside sources of supply. No bottleneck conditions. Imprinted pieces may be handled by automatic conveyor.

Economy No heat or pressure used. No expensive leaf. No complicated drying ovens. No extra operations or costs. No breakage or distortion. Many pieces, heretofore requiring expensive methods, now successfully handled. Ink cost, two cents per thousand imprints (approx. 2" sq.) in two colors.

Versatility Adapted to almost any shape or contour; to any surface or finish; to any material and to any size piece. Size of imprint up to 4" x 18", according to model. Patented plate holder permits quick change for variable work. Colors and design completely changed in two minutes.

Convenience Compact, lightweight, portable unit "goes on location" about plant to serve varied needs. Hand operated and motor driven models available.

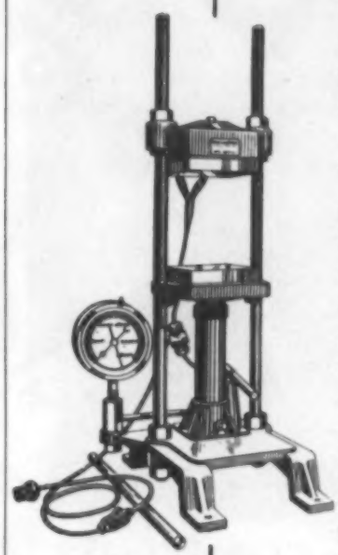
If interested in production in your own plant, send specifications and samples for return. Or arrange to see a demonstration at our plant. Or write for descriptive folder.

MARKEM MACHINE CO.
60 Emerald Street
KEENE, N. H.

MARKEM PLASTIC PRINTERS

make certain that your molder is MARKEM equipped

YOUR OWN RESEARCH AT LOW COST



Have you ever considered how little it may cost to do your own research, testing, sample making?

On the inexpensive little Carver Laboratory Press, many of the great plastics materials and highly profitable molding techniques were developed!

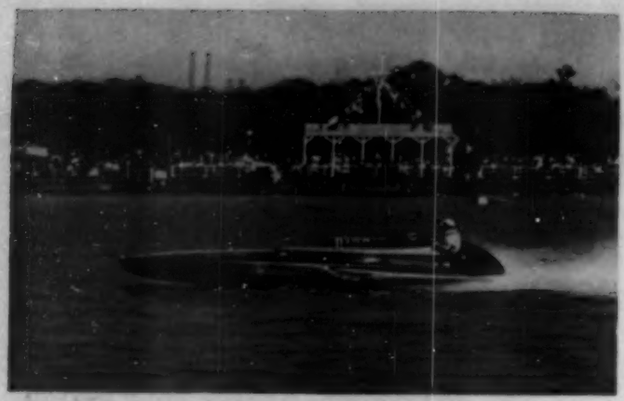
The Carver Laboratory Press is a self contained, hand operated unit that is standard in any laboratory and weighs but 125 lbs.

Developed particularly for molding in plastics, it gives pressures up to 20,000 lbs., temperatures up to 400° F, with electric or steam hot plates, large accurate pressure gauge, and thermometer pockets for checking temperatures.

Write for complete catalog.

THE CARVER LABORATORY PRESS

FRED S. CARVER
HYDRAULIC EQUIPMENT
343 HUDSON ST., NEW YORK
In London BAKER PERKINS Ltd.



13

14

COURTESY U. S. PLYWOOD CORP.

13—"Notre Dame," 1940 world's record winning speedboat has a hull made of 1/2" mahogany plastic-plywood. 14—Paneled walls of the Supreme Court Room, Raleigh, North Carolina, are of plastic plywood

try of the urea-formaldehyde and phenol-formaldehyde resins distinguishes the present plywoods from their predecessors. The physical and chemical properties which characterize these plastics, which they in turn impart to plastics plywood products, broaden their scope. They in fact provide them with properties which make them, for example, more important as construction materials, for making concrete forms, for commercial, industrial and home building and for manufacturing aircraft. The features of these resinous materials which make them ideal bonding substances are their general stability, their moisture resistance, their immunity to fungi attack and their adhesive qualities.

Several techniques prevail in the application of these plastic bonding mediums. It is general practice in manufacturing plastic plywood from a soft wood such as Douglas Fir to apply the bond in a viscose form usually by a mechanical glue spreader. In this class of wood the surface undulations have no deleterious effect on the final result. In manufacturing plastic plywood from hardwood it is found desirable to use an agent for distributing the adhesive. Paper impregnated with resin serves the purpose. It is used as an interlayer becoming a permanent part of the plywood.

Both phenol-formaldehyde and urea-formaldehyde resins are widely used in the industry. The phenol-formaldehyde type is applied without the addition of any other less expensive substance to extend its application. Extenders are widely used with the urea-formaldehyde resins. These do not impair its suitability for bonding. They do have a bearing on properties of the plywood; these are taken into consideration in applications for which they are intended.

While production in plastic plywoods made with thermosetting resins has made extensive progress, the possibilities of thermoplastics haven't gone unnoticed. They have come in for much experimental work with certain types having been used in aircraft parts. (See MODERN PLASTICS, July 1940, page 25.)

Robertson metal

Veneers are also bonded to metal. Some materials are processed in this manner they are known as Robertson Bonded Metal. A core of sheet steel serves as the base. A primary bond of cloth and metallic adhesive is next applied. To this is then secured a layer of coarse woven cloth. To this composite using a phenolic resin adhesive, the wood veneer surface is applied. The aggregate of plies; cloth, phenolic resin and wood veneer are then molded or hot pressed as it is referred to by the plywood manufacturers. Wood bonded to metal in this manner can be machined and formed by bending to reasonable limits. Where sharp radii are desired water immersion is required. Since the material possesses the metal base, it has fire resistance features that pass the Board of Fire Writers' requirements in certain restricted building zones.

Panel assembly

For the actual assembly of core, cross-banding and face veneers into a plywood panel, all laminae are dried down to a uniform moisture content and ironed flat. The cores are also dried down in kilns to a uniform moisture content and then planed to uniform thickness. The handling of panel assembly when resins are used is somewhat complicated by the unique character of the adhesive, since resins rely for their adhesive quality on the chemical change affected by simultaneous application of heat and pressure instead of evaporation which affects the drying and setting of glues. Faces, cross-bands and cores used in the resin process are held in an air-conditioned room for from one to three days in advance of their use so that their moisture content can be accurately controlled. The adhesive is applied either in thin sheets or with a glue spreader (depending upon the type) and the individual assemblies placed in compartments of the hot plate press whose platens are steam heat controlled. Under heat and pressure the resin first flows and then hardens. The resulting glue line is insoluble in water and proof against bacteriological deterioration, plastic plywood panels made by

CLASSIFIED

WANTED: Stainless Steel or Nickel Kettle, Vacuum Pan, Hydraulic Press, Preform Machine and Mixer. Reply Box 275, Modern Plastics. No Dealers.

PLASTIC MIXING & MOLDING EQUIPMENT—Factory rebuilt—Hot Rolls or Mixing Mills, Hobbing and Die Sinking Presses, Semi-automatic and Standard Molding Presses, Hydraulic Pumps, Accumulators, Intensifiers. Reply Box 294, Modern Plastics.

WANTED: CELLULOSE ACETATE SCRAP, unground or reground, as well as lumps, also acrylic or methacrylic resin scrap and celluloid scrap. Send details concerning quantities and price. Reply Box 318, Modern Plastics.

FOR SALE: Birm. 6″ x 12″ Lab. Rubber Mill, M. D.; 10—Semi-Auto. Presses, 75 to 400 ton, ejectors and pull-backs; 2—40″ Mixing Rolls; 4—Gould Triplex Hydraulic Pumps, 2—1500 PSI, 35 GPM, 2—3000 PSI, 18 GPM; 2—W.S. 4-cyl. opposed Hydraulic Pumps, 6000 PSI, 25 GPM, 100 HP motor drive; W.S. Hydro-Pneumatic Accumulator, 8″ ram, 48″ stroke, 42″ air cylinder, 5000 PSI; 3—24″ x 24″ Hydraulic Presses; 4″ Extruder; 7—W. & P. Mixers. Send for Complete List. Reply Box 385, Modern Plastics.

FOR IMMEDIATE SALE: Semi-Automatic Hydraulic Presses, 1—250 Ton, 18″ Ram, 28″ x 24″ Platens, 2000 lbs.; 1—175 Ton, 18″ Ram, 28″ x 24″ Platens, 1500 lbs.; 8—125 Ton, 13″ Ram, 23″ x 17″ Platens, 2000 lbs. Large stocks Hydraulic Presses, Pumps & Accumulators, Preform Machines, Rotary Cutters, Mixers, Grinders, Pulverizer, Tumbling Barrels, Drill Presses, Lathes, Gas Boilers, etc. Send for Bulletin #156 and #128. We also buy your surplus machinery for cash. Reply Box 405, Modern Plastics.

Sales representative Chemical Engineer with fourteen years Industrial Sales and Engineering experience in plastics and allied industries desires Sales or Technical connection with Plastics Manufacturer. Have extensive acquaintance with Engineers, Purchasing Agents and Industrial executives in Midwestern territory. Excellent references. Reply Box 409, Modern Plastics.

WANTED: Connection with individual chemist or company in order to test and introduce new Cellulose Filler offering great economical advantages. Reply Box 410, Modern Plastics.

OBSOLETE molds of various kinds are badly needed for instruction purposes in our educational program. If you can contribute one or more we will send forwarding instructions and assume transportation costs. Address: E. F. Lougee, Plastics I.T.I., 190 So. Alvarado Street, Los Angeles, Calif.

For Sale 5″ Pocket comb light weight injection mould six cavity latest design, made by one of the best mould manufacturers. This mould is capable of very fast production at low price. Ready for immediate delivery. Mould cost to-day approximately $1,500. Will sell reasonable. Reply Box 411, Modern Plastics.

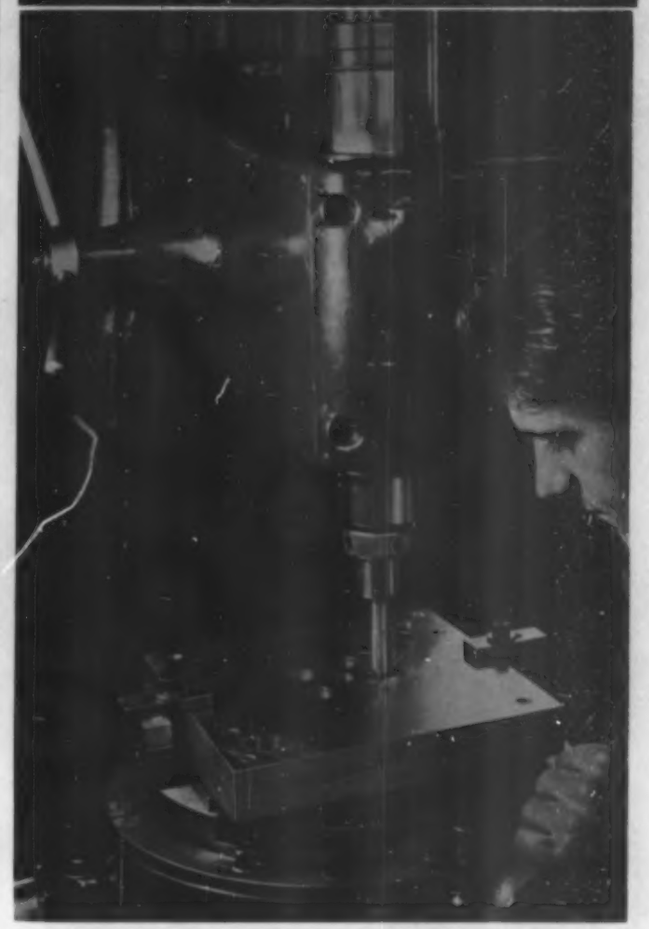
WANTED: Colton or Stokes Tablet machines all types. If you have one, please give full details as well as your present asking price. Reply Box 412, Modern Plastics.

WANTED: ROTARY CUTTER to grind plastic scrap. Must be in good condition. State size, capacity, type of bearings, make and price. Reply Box 413, Modern Plastics.

FOR SALE: Approximately 3000 pounds of nitrate tubing in various colors—approximately 30 inch lengths O.D. .500 x I.D. .350 Samples upon request. Reply Box 245, Modern Plastics, Meadville, Pennsylvania.

WANTED: Man with commercial background in plastics capable of aiding in development of product in extrusion process. Prefer man with mechanical and engineering ability and actual practical experience. State age, salary, education, experience, past connections, references. Reply Box 414, Modern Plastics.

UNUSUAL SKILL AND ACCURACY IN TOOL MAKING



ASSURES THE SUCCESS OF SINKO'S INTRICATE INJECTION MOLDINGS

SINKO craftsmanship reaches an extreme degree of efficiency in our tooling division. Modern methods and machinery are skillfully guided by experienced heads and hands. The specifications of our engineers and designers are recreated from drawings to metal with amazing precision and accuracy. That is why, when molds are mounted in presses, production of even the most intricate moldings is off to a flying start . . . deliveries are made as promised, and the satisfaction of our customers is assured.

Precision injection molding service by SINKO is employed by many of America's leading users of plastics. Have you a simple or unsolved molding problem? For economy's sake . . . let's talk about it!

Sinko
PRECISION INJECTION MOLDING

SINKO TOOL AND MANUFACTURING CO.
351 NORTH CRAWFORD AVE., CHICAGO, ILL.
62 N. NOBLE ST., INDIANAPOLIS • 6520 CASS AVE., DETROIT
POTTER & DUGAN, INC., 29 WILKESON ST., BUFFALO
L. D. MOORE, 4030 CHOUTEAU AVE., ST. LOUIS

15—*This new office building at Boeing Aircraft's plant No. 2 demonstrates the suitability of plastic plywood for exterior structural purposes*

this process—particularly those made with phenolic resin—being proof even against continued boiling. One of the latest developments of this type of panel is for planking and decking of small boats, particularly of the high speed, racing types.

Standards

Standard panel thicknesses run from 1/4 in. by eighths to 13/16 in. either 3-ply or 5-ply.

Standard Plastic Plywood Construction—in order of expense:

Low Cost	1/4 in. thick—3-ply Rotary Core
Increased Permanency	1/4 in. thick—5-ply Rotary Core
Increased Rigidity	3/8 in. thick—5-ply Rotary Core
Maximum Rigidity and Permanency	1/2 in. thick—5-ply Lumber Core
	13/16 in. thick—5-ply Lumber Core

Special constructions for bending purposes are frequently produced 2-ply, but this construction sacrifices some of the normal characteristics. Thinner panels from 3-ply 3/64-in. and thicker panels up to 7-in. thicknesses are manufactured for special purposes. Such constructions are designed by engineers to meet unusual strength requirements. Formulae for the computation of the strength of special constructions are available on request to the U. S. Forest Products Laboratory.

While many varied industries have already found plastic plywood indispensable, the field for its specialized applications is broadening steadily. The unlimited range of variations in panel construction gives plastic plywood a use flexibility of wide appeal.

Luminescent plastics

(*Continued from page 45*) coated with fluorescent materials, they cause it to glow, reproducing the image so that it can be seen.

Further stimulus comes from research on fluorescent lighting. Long tubes are coated with materials which glow when struck by rays generated within the tube, through which an electrical current passes. With many articles, though, coating as a means of providing luminescence or fluorescence leaves much to be desired. When applied as a paint or an ink, the spreading of the element over a wide thin surface tends to cut down on both intensity and longevity.

Plastics, on the other hand, offer an almost ideal medium for many applications. In a plastic, either in molded or sheet form, the glowing element is distributed through the entire thickness. Beneath each square inch of surface there is a high concentration of effective luminescent or fluorescent compound.

Luminescent molding compounds of both polystyrene and cellulose acetate, although rather new, are now widely used in this country. In applications such as electric switch plates, they are particularly useful. Sunlight during the day or artificial light in the evening charges these plates and all night they glow with subdued, yet unmistakable light. No stumbling or fumbling is needed to find switches in a home where these plates are installed. (Fig. 2.)

A luminescent gardenia is a novelty finding wide popularity. (Fig. 1.) This ingenious piece of costume jewelry is intended primarily for evening wear, although quite appropriate for daytime, too. Even sportsmen have not been forgotten in the uses of these new plastics. Luminescent fishing lures (Fig. 3) make night fishing a real pleasure. The fish have no way of knowing that the lures are but a trick of modern science to ensnare them, and go for them in schools. In decorating nurseries the newest thing is luminous wall decorations. These, in addition to adding a sprightly note in the daytime, are fascinating and mysterious, yet reassuring to children at night.

Fluorescent plastics have also been used in a number of interesting applications. In displays, particularly, they are effective. In arranging these displays, so-called black light is used. The light source gives off rays which are totally invisible, but fluorescent plastics respond to such illumination and cast their own bright glow without revealing the source of light. Sheets of this material are etched on the surface and the etching as well as the edges glows with an especially strong light.

This effect is also noticeable in sunlight or ordinary room lighting and it is not necessary to use black light to produce startling effects. Advertising cards, for instance, have been designed with a piece of red fluorescent material to represent a bar of red-hot iron, giving a very life-like effect.

Unusual combinations of colors and inlay decorative effects are possible in laminated plastics through the incorporation of fluorescent chemicals in the laminating resins. These chemically treated sections can be arranged in form and combination as is done with the usual decorative inlays. (See MODERN PLASTICS, October 1940, p. 46.)

Another important application is in theaters where each aisle seat is spotted with a tiny piece of plastic. When a ray of black light is directed on these pieces, a path is automatically illuminated from the front to the rear of the aisle. No interference with the screen is possible because of the invisibility of the black light.

The development of these new plastics, drawing on research in many fields and adding it to the store of experience amassed in plastic technology, opens new possibilities in the creative application of plastic materials in many areas of design, architecture and industry.

Credits: Fish lures and Gardenia molded by Cruver Mfg. Co.; Glo-plates by Atlantic Plastics; Monsanto fluorescent cellulose acetate.

SPACE . . . . and TIME
in a UNIVERSAL MOLDING

Universal combines clock and radio into one beautiful plastic cabinet. Molded in one piece, its strength and beauty are typical of the products of UP service.

UNIVERSAL PLASTICS CORPORATION
Custom Molders
Factory: 235 Jersey Avenue, New Brunswick, N. J. • New York Office: 500 Fifth Avenue

ARE YOUR PLASTICS **UNIFORM?**

Modern production demands absolute uniformity of color, form and strength. Precise control of mold temperatures is essential to produce plastics that satisfy today's rigid requirements. That is why powder manufacturers recommend the use of a Cambridge Mold Pyrometer. With it you can check temperatures in every mold cavity quickly, easily and accurately. Its routine use will help you cut down rejects.

Combination and Single Purpose Instruments

Cambridge Instrument Co., Inc.
3732 Grand Central Terminal
New York City

CAMBRIDGE
Mold, Surface and Needle
PYROMETERS

Bulletin 194—S gives details of these instruments. They help save money and make better plastics

Ameroid

CASEIN PLASTIC

- RODS
- DISCS
- SHEETS
- BLANKS
- PUNCHED FLAT SHAPES

Non-inflammable
•
Readily turned and machined
•
Wide color range

—for Fabricators

AMERICAN PLASTICS CORP.
225 West 34th St. New York City

Also manufacturers of
BUTTONS, BUCKLES, Game Parts, etc.

Cellulose ethers

(*Continued from page 62*) make hot drawing and forming mass production operations.[12] Thin films have been shown to transmit more than 90 percent of infrared radiation over the entire range except for a narrow absorption band at about 10^{-3} cms.[13] Ethylcellulose films plasticized with penta-glycol are claimed as transparent sheet wrapping materials.[14]

Coatings

An extensive laboratory manual on the properties of ethylcellulose and its compositions with solvents, plasticizers, resins and varnish oils was published during the year.[15] This handbook gives the basis for formulating an almost infinite variety of lacquer compositions as well as information on the use of ethylcellulose to body drying oils and to modify varnishes—Spirit varnishes are said to be greatly improved by the incorporation of small percentages.[16] Ethylcellulose and benzylcellulose compositions have been compared to cellulose esters for aircraft fabric dopes.[17] Weathering data on ethylcellulose lacquers have been issued[18] and another general discussion of its properties has appeared.[19]

The patent literature in 1940 attests the versatility of ethylcellulose. It is contained in moistureproof compositions for application to wrapping paper,[20] sausage casings[21] and transparent films.[22–26] A novel use for ethylcellulose compositions is claimed to be the impregnation of silk for surgical sutures.[28] Other uses of ethylcellulose coatings which have been patented are a base for nail polish[29] and a non-adherent backing coating for adhesive tape.[30] Ethylcellulose coated embossed paper cover stock[31] has been claimed as well as a method of recovering ethylcellulose from coated paper broke.[32] Hot melt compositions for application either as coatings or as printing inks have been claimed.[33] Ethylcellulose compositions have been patented as pigment dispersion media for making pigment chips,[34] colored lacquers[35,36] and spirit printing inks.[37] Nonflammable cellulose ether lacquers are said to result from the use of salts of dimethyl phosphoric acid.[38]

13. A. J. Wells, J. Applied Physics *11*, 137–140 (Feb. 1940).
14. U. S. Pat. 2,219,296, Wm. Hale Charch to E. I. du Pont de Nemours.
15. The Dow Chemical Co., "Ethocel Handbook," Feb. 1940.
16. R. C. Ernst, J. B. Tepe, and I. W. Hutchinson, Jr., Ind. Eng. Chem. *32*, 1539 (1940).
17. F. W. Reinhardt and G. M. Kline, Ind. Eng. Chem., *32*, 185 (1940).
18. Hercules Powder Co., Suppl. to Form 585A, June 1940.
19. W. Koch, Chem. and Ind. 59, 329 (1940).
20. U. S. Pat. 2,193, 831, J. A. Mitchell to E. I. du Pont de Nemours.
21. U. S. Pat. 2,201,457, J. P. Smith and W. L. Henderson to Visking Corp
22. U. S. Pat. 2,205,428, J. A. Mitchell to E. I. du Pont de Nemours.
23. U. S. Pat. 2,213,252, J. A. Mitchell to E. I. du Pont de Nemours.
24. U. S. Pat. 2,205,428, J. A. Mitchell to E. I. du Pont de Nemours.
25. U. S. Pat. 2,205,210, T. R. Latour to E. I. du Pont de Nemours.
26. U. S. Pat. 2,192,314, R. F. Izard and J. A. Mitchell to E. I. du Pont de Nemours.
27. U. S. Pat. 2,201,747, A. W. Staudt, to E. I. du Pont de Nemours.
28. U. S. Pat. 2,193,188, T. F. Bradley to American Cyanamide Co.
29. U. S. Pat. 2,215,898, R. J. Anderson to The Vorac Co.
30. Brit. Pat. 518,483, N. Van Cleef, et al.
31. U. S. Pat. 2,186,957, W. R. Collings and J. J. Hoeltzel to The Dow Chemical Co.
32. U. S. Pat. 2,183,039, R. D. Freeman to The Dow Chemical Co.
33. U. S. Pat. 2,204,550, J. D. Murray to The Murray Liquafilm Corp.
34. U. S. Pat. 2,184,539, D. R. Wiggam to Hercules Powder Co.
35. Brit. Pat. 517,640, Binney-Smith and Co.
36. U. S. Pat. 2,205,985, A. J. LaPointe to Devoe and Reynolds Co.
37. U. S. Pat. 2,200,069, H. A. Lube and C. K. Black to E. I. du Pont de Nemours.
38. U. S. Pat. 2,202,124, H. J. Tattersall to Imperial Chemical Industries Ltd.

Textile printing

Fabric printing with emulsion pastes of both pigments and soluble dyestuffs has made rapid progress during the year.[39] Cellulose ethers are said to be useful thickening agents for the lacquer phases of both types of printing pastes.[40–44] An addition to the art of printing fabrics and textiles with pigmented lacquers has also appeared.[45]

Miscellaneous products

Sound recording disks, having recording layers of ethylcellulose compositions, have been placed upon the market during the past year. A new composition for instantaneous sound recording has been claimed.[46] An electrical insulating sheet has been patented which employs an ethylcellulose composition as a binder for mica flakes.[47]

39. E. W. K. Schwarz, American Dyestuff Reporter 29, No. 1, p. 6 (Jan. 1940).
40. U. S. Pat. 2,202,283, N. S. Cassel to Interchemical Corp.
41. U. S. Pat. 2,213,126, W. L. Jones to Interchemical Corp.
42. U. S. Pat. 2,198,669, H. Jenett and S. Meeker to Interchemical Corp.
43. U. S. Pats. 2,222,581–2, H. Jenett to Interchemical Corp.
44. Brit. Pats. 522,941, 523,090, 526,853 Interchemical Corp.
45. U. S. Pat. 2,188,073, E. H. Bucy to Atlas Powder Co.
46. U. S. Pat. 2,203,983, H. A. dePhillips.
47. U. S. Pat. 2,210,704, A. L. Brown and L. R. Hill to Westinghouse Electric and Manufacturing Co.

Urea resin adhesives

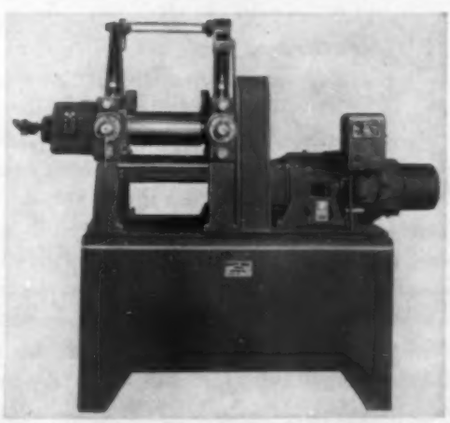
(*Continued from page 44*)

The resulting characteristics are of interest to all big industrial users of adhesives. The bond is, of course, extremely strong, but many glues make a strong bond. More, it is reported to be proof against water, or moisture, or humidity, or stains or solvents. The urea-formaldehyde bond, after polymerization, is insoluble, and because it lacks protein elements it is proof against fungus. It does not stain wood, which is important to manufacturers of fine grade cabinet work and users of delicate veneers. Although the bond is strong a few hours after gluing, and the piece can be machined, the glue line does not attain its maximum strength and water resistance for several days.

Properly handled, plastic glue provides for the first time an adhesive which is stronger than the wood it bonds together. It has had and is having a marked effect in stimulating the entire wood-working industry. Among the first uses are a number which have set startling precedents. One of the great automotive body builders, for example, reports a first year of its use without a single glue failure, which is a revolutionary fact in the industry. The same statement comes from a famous maker of cabinets and housings which undergo severe strain. An aircraft manufacturer uses it in the laminated plywood door for the bomb bay on the big bombers, attaining thereby the desired lightness and strength. It was employed in making skis, which are subject both to difficult moisture conditions and to rough handling; beer barrel staves; boat building;

Blazing NEW TRAILS
. . . in plastics, pioneering new applications of the miracle materials is routine at American Insulator. We have the designers, the toolshop, the presses, the finishers to manufacture every plastic into any form. Bring us your plastic problem for quick, satisfactory solution.
American Insulator Corp.
Plant • NEW FREEDOM • PENNSYLVANIA
SALES OFFICES:
BOSTON
BUFFALO
CHATTANOOGA
CHICAGO
CLEVELAND
DETROIT
LOS ANGELES
ST. PAUL
STRATFORD
NEW YORK
PHILADELPHIA
ST. LOUIS
Write for FREE 48-page book giving basic plastics data.
Sturdy pistol grip injection molded in one piece of cellulose acetate for Harrington & Richardson Arms Co.
SILVER ANNIVERSARY YEAR
AICO

A LABORATORY MILL
Designed For The PLASTIC INDUSTRY



6 x 12" MILL With Geared Head Motor.
Other Standard Sizes Also Available.
Write for Prices and Specifications

WM. R. THROPP & SONS CO.
TRENTON, N. J. EST. 1888

6 REASONS WHY
Manufacturers of High Grade Equipment Specify

BARCO
Swivel Joints

1. Steam does not injure the gaskets. 2. Compensation for slight side movements. 3. Extra long life. 4. Automatic adjustment. 5. Fluid tight under the strains of alternating steam and cold water. 6. Freedom from condensation leaks.

The production savings which these features make possible through uninterrupted operation will be found to contribute largely to manufacturing profits.

Write for Catalog 257

Barco Manufacturing Co.
1813 Winnemac Avenue
CHICAGO, ILL.
In Canada: The Holden Co., Ltd.

wooden airplane propellers; and an increasing number of similar intricate jobs.

One of the innovations it has made possible is a modified process which is neither hot press nor cold press type. The cold press method is used, and the articles glued are then placed overnight in a temperature of 120 deg., bringing about an accelerated aging and setting process and securing a perfect bond. This has been developed in an industry formerly subject to constant complaints for glue failures; since adopting the new method, no glue failures have been reported.

Both the hot and cold types can be extended, and even when greatly extended still show greater strength than is usually called for in standard tests.

Cold press type

Considering the technique of using each kind of process, the normal proportions for the cold press type are 100 lb. of urea-formaldehyde powdered glue, 65 lb. of water, and 2 lb. of the cold hardener. At normal room temperatures (70 deg. F.) a solution of cold press glue with the hardener has a working life of approximately four hours. At higher temperatures, the life of the mix is shorter, and at lower temperatures substantially longer. As the glue solution without the hardener is quite stable, it is sometimes desirable to mix up a batch of glue sufficient for several days' use and add the proper amounts of hardener to small lots drawn off as needed. Wood requires no special preliminary treatment before applying glue.

The glue may be applied with any modern glue spreader. Grooved rubber rolls are preferable, because they give the most economical and even spread. However, finely grooved metal rolls are satisfactory. In some cases application by spraying, brushing, or dipping is desirable. The required spread for this type glue is substantially lower than for animal, vegetable and casein glues. A spread of from 30 to 40 lb. per 1000 sq. ft. of single glue line should be sufficient.

Pressure must be applied while the glue is wet. The assembly period under average conditions should not be over 15 minutes. Pressures for plywood construction may range from 150 to 300 lb. per sq. in., depending upon the amount of spread used and upon the type and cutting of the veneer. With simple laminations and tight fitting joints, pressure may be released before the glue has completely set, provided unduly rough handling is avoided. At average temperatures, this interval is from 2 to 6 hours. When the glue room temperature is low or when it is desired to speed up production, the application of moderate heat is desirable. Temperatures from 120 deg. to 200 deg. F. are suggested, depending upon the heating interval and the type of construction.

Because of the relatively small quantity of water in a urea-formaldehyde glue line, in comparison with other types of glue, no special treatment of panels or other products is necessary after pressing.

When a high degree of water resistance and maximum strength are desired, the plastic glue should be used as supplied, without additions. For purposes of economy, however, it is sometimes desirable to extend it by dilution with flour, preferably wheat. For general practice it is not recommended that this exceed 50 lb. of flour per 100 lb. of powdered glue. At normal room temperatures (70 deg. F.) an extended solution of cold press glue with hardener has a working life of approximately 5 hours.

The required spread for extended glue is somewhat higher than for straight urea-formaldehyde glue. Spreads of 35 to 45 lb. per 1000 sq. ft. single glue line should be sufficient. Extension with flour tends to retard slightly the setting of the cold press glue.

Hot press type

An aqueous solution is prepared by dissolving 100 lb. of the dry material in 60 lb. of water. The set-up of the resin in the hot press is created by the action of a hardener. This hardener is supplied in dry, crystalline form, and is dissolved in the glue solution. In every case, regardless of the quantity of filler used, 2 lb. of hot hardener should be used with each 100 lb. of urea-formaldehyde dry resin. Dry resin is put into the mixer and agitation begun. Next add quickly approximately three-fourths of the necessary water. Stir the mix until a smooth paste results. Then dissolve the specified quantity of hardener in the remaining water. This hardener solution should then be added slowly to the mix. Stirring should be continued for several minutes. At normal room temperatures, a solution of urea-formaldehyde resin with hot hardener has a liquid life of approximately 24 hours. Enough mixture may be prepared at one time for a normal day's run. At the end of the day, any left-over material should be removed from the spreader and mixer and both washed thoroughly. This excess glue can be kept in a closed container over night and added to the first batch mixed the following morning.

The required spread is from 25 to 40 lb. per 1000 sq. ft. of single line. Normally, very good results will be obtained with an assembly period of $^1/_2$ hr. or less. When a high percentage of filler is used, the panel should be pressed while the glue line is wet. With straight resin, the assembly period may be extended to 48 hours. The recommended pressing temperature is from 220 deg. F. to 240 deg. F. Temperatures as high as 300 deg. F. may be employed in special cases, such as 7-ply construction or where a rapid cure is required. When using the resin without filler, for panels with core up to and including $^1/_8$ in., the minimum pressing time is 2 min. plus 1 min. for every $^1/_{20}$ in. from the platen to the deepest glue line. Using urea resin with flour filler, add to the periods above 1 minute for each 50 lb. of filler used per 100 lb. of resin. No special treatment of panels is necessary after pressing. Panels removed from the presses may be sanded to the exact required dimensions or otherwise finished, as the processing specifications may require. They may be stacked without strips or they may be machined immediately.

Credits: Weldwood, urea-formaldehyde glue, marketed by U. S. Plywood.

YOUR PLASTICS WILL BE STRONGER WHEN YOU USE L-O-N-G COTTON FILLER!

IMPACT strength, tensile strength, flexural strength, compressive strength are all increased by ascertainable percentiles when the plastic is filled with Claremont long cotton flocks. That is the basic reason why well over 25,000,000 pounds of Claremont fibers have been used by the U.S. plastics industry in the last 20 years. Don't skimp on your filler. Use the best, use Claremont.

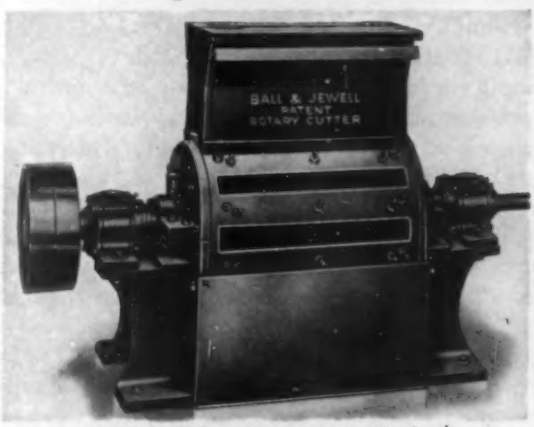
Claremont Waste Mfg. Co.
Claremont New Hampshire

The Country's Leading Makers of Cotton Flocks

A Most Effective
SELLING DISPLAY
A MODERN PLASTIC PRODUCT
CLEAN — SANITARY — PERMANENT

Moulded in one piece
STRENGTH — DURABILITY

Northern
INDUSTRIAL CHEMICAL CO.
11 ELKINS STREET, So. BOSTON, MASS.
PLASTIC SPECIALISTS FOR MORE THAN 25 YEARS



Model No. ½ Rotary Cutter—300-450 lbs. hourly

THE **PROOF** OF THE GRINDER

. . . is in its use. And Ball & Jewell grinders are used by all the important material suppliers in the plastics industry. Tennessee-Eastman, DuPont, Celluloid, Bakelite use Ball & Jewell grinders. Each has several of them.

MR. MOLDER, THAT'S THE TIP-OFF:
The people who use grinders most and with the most exacting requirements as to material cleanliness, continuous operation, etc., use Ball & Jewell grinders, standard of the highest quality in the field.

Every part of every Ball & Jewell grinder is made of the best possible material with the finest craftsmanship. That's the reason for their long life, low upkeep, satisfactory performance.

Write for FREE new book telling about these unusual grinders.

BALL & JEWELL
20 Franklin St. Brooklyn, N. Y.

REGULATING VALVES
for every Plastics Plant Service

Take, for example, the Reducing Valve shown at the right. It Handles Oil, Water or Air and is ideal for use in Plastics Plants.

Forged steel Body. Internal metal parts entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure. Truly modern in every respect.

We make regulating valves for every plastics plant service.

We have been making regulating valves *exclusively* for nearly a half century.

See partial list in the coupon at the right.

This exceptional Reducing Valve handles up to 6000 pounds pressure.

It is now being successfully and increasingly used in leading plastics plants.

Specify
ATLAS
Type "E"

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
277 South St., Newark, N. J.
Representatives in Principal Cities

☐ Please send complete information on the Atlas High Pressure Reducing Valve. Also, please send information on the following Atlas products.

☐ Campbell Boiler Feed Regulators	☐ Pump Governors
☐ Damper Regulators	☐ Float Valves
☐ Temperature Regulators	☐ Humidity Controllers
☐ Reducing Valves	☐ Thermostats
☐ Exhaust Control System	☐ Balanced Valves
☐ Pressure Regulators	☐ Control Valves
	☐ Oil Control Cocks

Phenolic bonded airplane

(*Continued from page 64*) literature, descriptions of three plastic airplanes.[1,2] Essentially all three are based on plastic-bonded or plastic-reinforced wood. True to tradition, one is reported to use a thermoplastic resin of the butyral type, one a phenolic resin and the third a urea-formaldehyde resin.

The use of wood and glue in aircraft manufacture is as old as the industry itself. High strength-weight ratio, high resilience, corrosion resistance, ease and rapidity of fabrication on high-speed machinery and the like, are all characteristics associated with wood. In the important matter of joint efficiency, wood again claims an advantage over the other materials. The most perfect weld in a steel structure anneals and reduces the strength of the base metal adjacent to the weld. The rivet demands the sacrifice of rivet holes. Even the spot weld converts its area of wrought base metal to a casting with consequent reduction in strength, but the glued joint needs no such sacrifices.

This optimistic picture, however, is not without its blemishes, since it must be recognized that the many advantages of wood have been offset to a great extent by the lack of permanent dependable joints in component parts. The great majority of failures were observed to be not in the wood itself, but in the joints. Exposure tests conducted by the Forest Products Laboratory have substantiated that joint failures with animal, vegetable and casein glues could be attributed primarily to a chemical hydrolysis of the glue, a decomposition by parasitic micro-organisms or a mechanical failure due to stresses developed in the wood, the latter being particularly serious if the glue is in a softened condition.

[1] Modern Plastics *17*, September 1939, 25, "Structural Conditions Favoring Plastics in Aircraft Structures."
[2] Modern Plastics *17*, July 1940, 25, "Molded Airplanes for Defense."

4—Test panel of low temperature bonded plywood after one year exposure on a roof

It had already been demonstrated that certain resin adhesives could resist water at elevated temperatures indefinitely, and were completely immune to the destructive micro-organisms. At the same time they resisted chemical hydrolysis, and were much stronger than the common glues. But these resin adhesives were used in hot presses at temperatures between about 250 deg and 325 deg. F. and it was clearly impractical to hot-press an assembled wing panel. The apparent need was then a cold-setting resin adhesive.

After some three years of intensive work with vinyl ester and acetal resins in the thermoplastic class and the urea- and phenol-formaldehyde resins in the thermosetting class, two formulations based on a phenolic resin of high molecular ratio were finally evolved. The trail of research led back to the elementary mechanics of gluing, and to the study of the microstructure of wood. The problems of non-uniform absorption and joint starvation were eventually overcome and a satisfactory control was established over a delicate chemical reaction, with the invaluable help of the resin producer.

The ideal of the strictly cold-setting resin has not yet been achieved. Any number of cold-setting preparations have been tested, and it may be taken as an axiom that the uniformity of the synthetic resin bond is only as good as the uniformity of temperature, and the dependability of the bond goes down with the temperature. The formulae were, therefore, developed to effect a cure of the resin at 140 deg. for a length of time compatible with production requirements. The problem of maintaining a large insulated room at a temperature of 140 deg. involved no special difficulties and the humidity can readily be controlled to maintain stability in the wood at that temperature.

The formulations mentioned have been extensively tested, it is reported, and evidence has been presented to show that they will produce uniform, dependable joints of typical phenolic resin performance, on any of the species of wood commonly used in aircraft manufacture, while the mixing, handling, spreading and clamping properties are almost identical with those of casein glue. Its use in production has been approved by the Civil Aeronautics Authority, we are told, and the partially completed wing pictured here has been taken from the production jigs to illustrate the principles described. In addition, military airplanes incorporating these principles are being constructed for the U. S. Air Corps in connection with our National Defense, but a description of them is not permitted at this time.

Shearing tests of dry joints in the soft woods such as spruce and bass gave no particular advantage to the resin, since the casein joints gave just as high a percentage of wood failure. The superior mechanical strength of the resin was shown in the shear tests of the hardwoods, typified by birch and maple. Where the average shear value was 2778 lbs. per sq. in. for the resin as compared to 1732 lbs. per sq. in. for casein glue. The specimens were of birch and the lowest percentage of wood failure was 80 for the resin as compared to 5 for casein glue. (*Please turn to next page*)

We Buy and Sell

PLASTIC SCRAP MATERIALS

- Celluloid
- Acetate
- Styrene
- Acrylic
- Vinyl Resins
- Sheets
- Rods
- Molding Powders
- Etc.

For 20 Years

we have been Buying—Reclaiming—Grinding—Cleaning and Selling Scrap Materials of All Kinds.

Our dealings are known by our numerous customers to be dependable and prompt.

No quantity of scrap material is too large or too small for us to handle.

Make us your *Headquarters*.

GERING PRODUCTS · INC·

SPECIALISTS—SCRAP MOLDING MATERIALS

Offices: RAHWAY, N. J. ● Factory: KENILWORTH, N. J.

Use

ELECTROFORM MOLDS

-for-

TRYOUTS... SHORT RUNS

Heating & Cooling Coil built into the mold

●

INEXPENSIVE — absolute reproduction of the original model guaranteed.

Send your model in for estimate.

ELECTROFORMING COMPANY

HARTLAND WISCONSIN

Once again an important radio company picks ATTLEBORO to produce the plastic molded housings for their sets.

Our modern plant and skilled personnel are integrated into a molding organization to deliver top-notch moldings, to meet your needs on time.

Try us on your next molding job. We are equally well-equipped to handle large or small pieces.

ASSOCIATED ATTLEBORO MANUFACTURERS, INC.

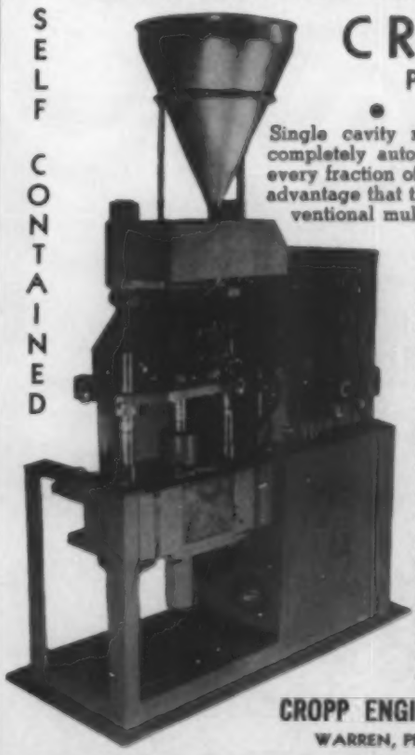
New York Office: 303 Fifth Ave.

ATTLEBORO, MASS.

SINGLE CAVITIES PRODUCE!

ON THE COMPLETELY AUTOMATIC

SELF CONTAINED



CROPP PRESS

● ● ●

Single cavity molds on CROPP completely automatic presses use every fraction of a second to such advantage that they often put conventional multiple cavity molds to shame.

Thus, besides obvious labor savings, one has savings of less costly molds, and less costly molds are delivered more quickly — thus paving the way for earlier deliveries for your customers.

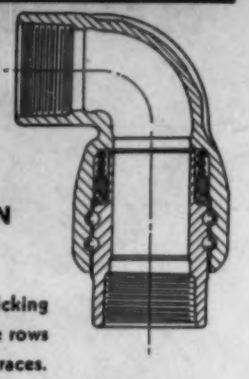
CROPP presses make small runs profitable, and allow molders to bid and get work that heretofore has been passed by as undesirable. May we quote?

CROPP ENGINEERING DIV.

WARREN, PENNSYLVANIA

CHIKSAN Ball Bearing SWING JOINTS for HIGH TEMPERATURES

Specially designed for handling superheated steam, liquids, gases and vapors at temperatures to 700° F and pressures to 500 lbs.



Style 30 High Temperature Swing Joint. Note streamlined design which permits unobstructed flow. Extra width at elbows to prevent pressure drop.

NOTHING TO TIGHTEN OR ADJUST

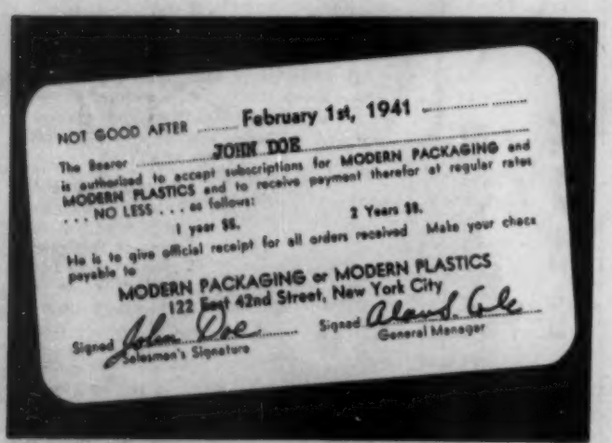
No packing glands to keep tight. No sticking or binding. Full 360° rotation on double rows of hardened steel balls in flame-hardened races. Eight different types . . . built of steel . . . threaded or flanged ends . . . sizes from ½" to 4". Specially designed pack-off.

Representatives in Principal Cities
Distributed Nationally by Crane Co.

CHIKSAN TOOL COMPANY
BREA, CALIFORNIA

SUBSCRIPTION WARNING

Pay your subscription agent only if he has our *Authorization Card* dated *February 1, 1941.*


NOT GOOD AFTER February 1st, 1941
The Bearer JOHN DOE
is authorized to accept subscriptions for MODERN PACKAGING and MODERN PLASTICS and to receive payment therefor at regular rates . . . NO LESS . . . as follows:
1 year $5. 2 Years $8.
He is to give official receipt for all orders received Make your checks payable to
MODERN PACKAGING or MODERN PLASTICS
122 East 42nd Street, New York City
Signed John Doe Salesman's Signature
Signed Alan S. Cole General Manager

Make checks payable to

MODERN PLASTICS

Chanin Building, 122 E. 42nd St., New York, N. Y.

In addition to a cold water immersion, a boiling test was arranged consisting of a cycle of three periods, 8 hrs. of boiling water, 8 hrs. of cold water, and 8 hrs. of drying. The cycle was continued for 200 hrs., after which the specimens were manually destroyed. No evidence of joint failure could be found, it is reported.

Another 4 ft. panel of typical wing construction was immersed in a tank of boiling water for a day, after which it was oven-baked to develop violent shrinkage stresses. Subsequent examination showed that the resin bond successfully resisted the stresses, while similar panels with other adhesives disintegrated in the boiling water after only a few hours' immersion.

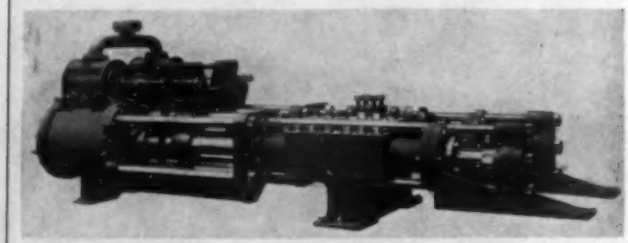
The test panel pictured (Fig. 4) has been cut loose from its moorings on the roof after over a year of exposure, while duplicate panels with other adhesives have long since collapsed.

With the rapid growth of both the plastics and the airplane industries, it is difficult to foretell their exact future relationships, but we may safely predict that the synthetic resins will increasingly continue to infiltrate the airplane structures and that their use will be associated with wood. As a reinforcement for the new prefabricated structural materials, as a reinforcement, binder and surfacer in the molded units, and as a bonding agent in structures of wood and prefrabricated materials, plastics have a niche in the aircraft field.

Credits: Catabond phenolic resin, by Catalin Corp.

Machinery & Equipment

(*Continued from page 76*)



● WARREN STEAM PUMP CO., INC., MAKES THIS duplex hydraulic pump, above, which measures 24 by 4¾ by 18 ft. Built in various sizes and capacities depending upon conditions of service, these pumps are available in single and compound duplex types. Forged steel plunger barrels are used for discharge pressures in excess of 1000 lb, according to the report.

● AUTOMATIC, VERTICAL, REVERSING TAPPING MAchine by Cleveland Tapping Machine Co. features a finger tip controlled clutch which is claimed to be so sensitive that a 10/32-in. hole can be tapped at high speed. A shift of the clutch lever and it taps ½ in.-13 in. steel at 360 r.p.m. In operation the machine is reported simple—one touch of the handle or foot lever per hole. Just start the tap, then release the pressure and both hands are free to handle the next piece of work until it is time to tap the next hole. Linear movement of the spindle and reversal in direction of rotation are handled automatically following initial set-up and this manual application of the tap.